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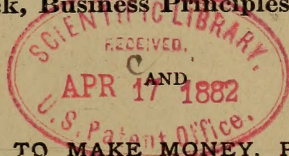
DOMESTIC ANIMALS

FARMING FOR PROFIT.

A HAND-BOOK FOR THE AMERICAN FARMER

A Practical Work, Devoted to

**Agriculture and Mechanics, Fruit-Growing and Gardening,
Live-Stock, Business Principles, Home Life,**

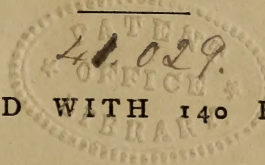


**SHOWING HOW TO MAKE MONEY, PRESERVE HEALTH
AND SECURE HAPPINESS**

—♦—ON THE FARM.—♦—

BY JOHN E. READ,

For Ten Years Associate Editor of the "Working Farmer," Special Contributor to the
"Ohio Farmer," "American Cultivator," and "Dirigo Rural."



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PREFACE.

HERE are many valuable books for the farmer already in the market, but the author believes that there is both room and a call for another work devoted specially to the interests of the class to which nearly half of the population of the country belongs. The present is a time of rapid progress, and the man who makes no effort to keep up with the times will soon be left far behind his competitors.

Times have changed since a work of this description has been published. Foreign markets have been opened, and the wants of home consumers have been greatly modified. New theories of tillage and new methods of fertilization and cultivation have been advanced and tested. Competition has become closer, and the necessity for a better style of farming has been made evident. Farmers have also become more willing to read and study, and have found that the *practical* agricultural writer is both a helper and a friend.

This book is not *sectional* in its character, but treats of the various interests of farmers in all parts of the country. It contains the results of an immense amount

of study and investigation. The best authorities have been freely consulted, and the author has endeavored to secure accuracy, bring the work down to the present time, and make it practical and instructive. Special care has been taken to make it attractive and valuable to the boys and young men who are coming upon the stage of active life, and are soon to be the farmers of the country.

This will be found a *comprehensive* work. An effort has been made to bring into one volume a vast amount of information which will be of practical value. The subjects treated are not confined to a single class, as is the case with too many books, but embrace *every department of farm business*.

Not only the leading principles, but many of the minor matters, which writers often overlook, but which have an important bearing upon the happiness and success of the farmer, are also noted. There are many suggestions which, it is hoped, will prove extremely useful to the beginner, while there is much which will merit the consideration of those who have been long in the service.

The teachings of this book have been adapted to the *present condition of the agricultural interests of the country*, and are designed to show how the farmer of to-day can achieve success in his work. The interests of the wife and children have not been forgotten, and it is believed that in the pages of this work each member

of the household can find something of personal interest.

The author is a practical farmer, acquainted with the details of farm management, and thoroughly used to manual labor. He has had many years experience as a writer for the Agricultural Press, and his articles have been very favorably received. He has also had extensive opportunities for observation in different sections of this country and Canada.

Written by a farmer, for farmers and their families, the Book is sent out with the hope that it will prove interesting and useful to all who shall read its pages.

ACKNOWLEDGMENTS.

THE AUTHOR tenders his sincere thanks to the many friends who in various ways have encouraged and aided him in his work.

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AGRICULTURE AND MECHANICS.

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FARMING AS AN OCCUPATION.

WHEN man was created in the image of God and given dominion over all the earth, he was directed by his CREATOR to dress and to keep the beautiful GARDEN in which he found a happy home. Thus at the very beginning of the history of the race God placed the stamp of His approval upon the labor of tilling the soil. And after the FALL, with all of its ruinous consequences, when man was driven out into the world, he was directed to continue the same employment. In due time he received the promise that the earth should be cursed no more, and that seed-time and harvest should not fail.

As this is the original work which God gave to men, we have the best of reasons for supposing that it is a form of employment which is especially suited to their requirements. And the history of the race to the present time has proved this belief to be well founded. Although as men multiplied upon the earth it seemed necessary that some should engage in other callings, yet agriculture has continued to hold a very prominent place among the industries of the world. As civilization has advanced, agriculture has become more and more necessary to the welfare of society. Although there have always been a few who have affected to despise manual toil and to look down upon

the laborer as a social inferior, this feeling has not lately been general, even among those who have not been compelled to work with their hands, and is now rapidly passing away from the minds of those who were once foolish enough to cherish it. As a class farmers are becoming more intelligent, thus fitting themselves for greater usefulness, and compelling the few who may have laid claim to social superiority to yield them the tribute of genuine respect. It certainly is not meet that the wealthy and educated classes should look with disdain upon the farmers, to whom, under God, they are indebted for their daily bread. Neither should the farmer rely upon the great benefit which his labor confers upon society as his sole claim to recognition and respect. All classes should remember that no mere employment has the power to make a man true and honorable. Character is something which is distinct from occupation. Some men would be true and noble, if they were compelled to engage in the most menial toil; while others would show no spark of manhood if they were invested with all of the rights and privileges of the most sacred calling. If a man is truly good, he will be good without regard to his occupation. He will be just as good as a farmer as he would if he were a merchant, a manufacturer, or a preacher. His employment will not make him either good or bad. If it is honest, it may be made an aid to the building and sustaining of a good character; but the motive and the will, the resolution and the action, which are the vital forces in the case, must come from the soul of the man himself, and are wholly outside of, and foreign to, his occupation. It is true that a dishonest calling will tend to make a bad man grow worse, but that it has no power to make a good man evil is evident from the fact that no really good man would have engaged in such an occupation. The man was bad before he entered the business. There are some honest callings which incidentally throw a man in the way of temptation, but they have no power to compel him to do wrong. Other callings surround a man with good

influences and shield him from temptation, but they cannot make him good. If his heart is corrupt, it will be altogether beyond the power of any calling to make him an upright and honorable man. Consequently no farmer should lay claim to respectability merely because he is a farmer. This is good as far as it goes, but it is not enough. He ought to strive by a noble character and a life above all reproach to confer honor upon his chosen occupation, rather than seek by the aid of his calling to attain a degree of social recognition which his actual merits do not warrant. Still he should always remember that his calling is one which was given and sanctioned by GOD; that there is nothing in it to degrade, but, when properly followed, very much that is elevating and ennobling. He should never blush to own that he is a farmer, or be ashamed of the fact that he tills the soil.

While the influence of agriculture upon the individual is good, its beneficial effect upon national progress and prosperity is marked to a much greater degree. History shows us that as nations rise, agriculture is more and more honored and respected, while as they decline, and keeping a very even pace with their downward progress, it falls into disrepute and decay. It was so with ROME, the greatest of all ancient powers, and it has been so with states and empires of lesser note. So it will always be; for agriculture is the only safe and sure foundation upon which a nation can be reared. It is plain to be seen that a nation which should produce none of its food supplies would be constantly dependent upon foreigners, and in case of war might be almost utterly helpless. Not only does a well-developed agriculture give a nation influence and power abroad, but it is also one of the greatest possible aids to a high state of civilization at home. It may never have occurred to the eminent artist and the brilliant scientist that but for the combined skill and labor of many farmers, they would be obliged to spend their time and strength working with their hands instead of following their

chosen pursuits. But this is a fact which all professional men should remember, that they are deeply interested in the progress of agriculture, because upon the success of farmers depends the possibility of their being able to work with their minds instead of their hands. For if agriculture were to decline to a point at which each farmer should produce only food enough to supply his own wants and those of his family, there would be no food for the non-producing classes, and they would be obliged to leave their professions and trades to engage in the cultivation of the soil. This would be the only way in which they could avoid starvation. Thus it will be seen that the better the agriculture of a country is managed, the higher the point to which civilization can be carried. The farmer as well as the thinker is a power to advance the civilization of the world.

Not only is it for the benefit of society that the agricultural interests of a country should be well developed, but it is also essential to the securing of the highest success by the farmers themselves. If the crops are properly chosen, there will be little danger of over-production. The higher the rate of production can be carried without glutting the market, the greater the surplus which the farmer can sell, the more leisure time he will have, and the greater the number of luxuries which he can enjoy. The highest development of our agricultural interests will prove an immense benefit to the farmers, the professional classes, and to the nation at large. By bringing to his aid the knowledge which is within his reach, and doing all that he can to elevate, and make successful and remunerative, his own occupation, the farmer is also helping the great army of laborers in the fields of literature, science and art.

While the advantages which have been enumerated are of great importance, the fact that farming gives a man almost unequalled opportunities for becoming independent, furnishes another and a strong inducement for choosing this occupation. There are very few kinds of business in which a small amount

of capital can be as safely invested, and still yield as good returns as it will in a farm, and there are very few occupations in which a man can engage with an equal certainty of always having plenty of work, and work which is so sure to be fairly remunerated. In order to become a lawyer a man must give many of the best years of his life to the acquirement of an education, which will cost a large sum of money, and he must then labor constantly and earnestly in order to secure anything like a reasonable degree of success. In the great majority of cases the same amount of money invested in buying a farm which must be spent in educating him, and an equal amount of hard work afterwards, would give him more money, and ten times more happiness as a farmer, than he ever can secure as a lawyer. There are brilliant examples of success in all the professions, but the majority of professional men never reach eminence nor obtain wealth. Considering the amount of money which is expended in fitting them for their positions, and in helping them to get started in life, they are no more successful than farmers. We are well aware that many utter the chronic complaint that "farming don't pay," but we are sure that they do not know whereof they do affirm. We know that there are many half-hearted farmers, men who have no faith in their business and but little in themselves, who are always ready to sell out, and constantly wanting to get into other business because they are not doing well where they are. But if these men were to show no more energy and skill in other business than they do in farming, they would not improve their condition by changing their occupation. Here, as in regard to character, very much depends upon the man himself. Some men do not get along well farming, and they would not get along well doing anything else. Other men make money on the farm. They would probably do well at other work. Still, some men have a special talent for certain kinds of business. In following their desires in this respect they will usually be more happy and more successful than they will if their wishes are not

regarded. But a taste for many kinds of work, and especially for farming, can easily be cultivated. While it is not the duty of every man to follow this calling, it is an occupation which most men can learn to like, and in which none except those who, by reason of ill-health, or of heavy burdens outside of their work, need wholly fail. The great majority of men whom inclination has brought, or necessity has driven, to the farm, may secure not only a reasonable but a highly satisfactory degree of success. If they will give their earnest attention to the business, and use the helps which are easily within their reach, they can make farming PAY. To aid his readers in this work, and show them how it can be performed, will be the aim of the writer in the following pages.

WHERE TO FARM.

IN a beautiful story by LONGFELLOW, a highly educated man is represented as desiring to write a romance. Month after month and year after year he sought in the realms of the imagination for the materials of which to construct the plot. Vague ideas filled his mind. Splendid visions sometimes came, but he was always seeking something far away; something a little better than he had yet secured. So it came to pass that the years fled away while he was dreaming, and the romance which he had fondly hoped was to immortalize his name was never even begun. Yet, during the time which he thus idled away, the materials for a splendid romance, even a tragedy involving terrible grief, heroic endurance, and Christ-like fortitude, were accumulating close to his very door. But his eyes were turned so far away in an effort to penetrate the mysterious and the unknown, that he neither saw the opportunity, nor realized that he was throwing away the greatest help to his cherished work which it was possible for him to receive. And it came to pass that all his dreams faded,

his years of anxious thought were vainly spent, and the confidence of his friends in his superior ability was destroyed, all because he would not use the materials within his reach, but was constantly seeking something so intangible and unreal that it always eluded his grasp. In looking over the record of such a life, with its glorious opportunities thrown away, it is very easy to see the mistake, and by far too easy to condemn. Yet this is only a picture of a multitude of lives. Look where we will we can find men who have neglected the best of chances, because, by the dazzling light of something far away, their eyes were closed to the benefits by which they were fairly surrounded. In looking over his past life many a man can see where he made a terrible mistake in seeking fortune in the distance and the future, instead of accepting the opportunities which were close at hand. And, as human nature remains the same, we find that the same scenes are constantly being re-enacted. The young do not always learn from the experience of the old. They prefer to push out into life for themselves. They insist upon drinking the bitter water before they will acknowledge that it is unpleasant and unwholesome. This is the case with too many of the young men of to-day. But there are many who are open to reason, who will listen to argument, and who will hearken to instruction. For their benefit, and also to strengthen in the faith some of our older readers, who may be wavering, we will devote a little space to a consideration of the subject of this chapter.

Farmers in this country are divided into two principal classes: those who are both the owners and managers of the farms upon which they live forming one, and those who work for other farmers comprising the other class. There are a very few who do not properly hold either of these positions, but an intermediate one, being managers, but neither owners nor laborers. But the two classes named above comprise nearly all of the farmers in the country. As a general rule they have the power

of choice as to the place in which they will farm. They cannot change without some expense: in a multitude of instances a change of location would involve quite a heavy loss; but to almost every one such a change is possible. The question, then, to be considered, is whether a change is desirable.

The fact that a change would involve some expense is not an unanswerable argument against a removal from the present location. Almost everything of value (as well as many worthless articles) costs something. Buying a reaper is expensive, but it is often a necessary expense, and one which proves a source of great profit in the end. So with many other expenses which the farmer is obliged to incur. Now if a removal holds out a certainty of great and permanent improvement, with no drawback which shall neutralize the apparent gain, the fact that it is somewhat expensive should not prevent its being made. But in case that a change of location means only a change of evils—if in leaving one unpleasant feature the farmer must accept another equally bad, and perhaps much worse, in his new home—it does not seem possible that the expense of removal can be justified. Probably ninety-nine farmers in every one hundred have something unpleasant in their surroundings, and it is very likely that a large part of them have a vague and indefinite idea that if they could only move to some other town, or some other State, they would be happier and more prosperous than they possibly can be while remaining in their present homes. There are some things which these farmers should have in mind, but which, unless they have been around in the world considerably, they are almost sure to overlook. One of these, and it is a very important consideration, is the fact that there is a great law of compensations which is in force everywhere, and which balances many evils with equal and corresponding benefits. The farmer in Maine will suffer severely during the long and unpleasant winter, and he may envy the farmer in Georgia, who is not exposed to the terrible cold. But while the Southern farmer

is comfortable when the Northern farmer is almost afraid that he shall freeze, there comes a time when the suffering and the comfort are exchanged.

In the summer the Southern farmer suffers from the broiling heat, while, with the exception of a few days, the Northern farmer is quite comfortable. Both parties have their time of pleasant surroundings and their seasons of discomfort. One suffers from the cold, the other from the heat. Both suffer, and no one can tell which suffers the most. So with all other things. The man who delights in mountain scenery and gratifies his desires must put up with the inconvenience, and perform the many extra labors, which living in a mountainous region involves. The farmer who desires a retired place, far away from the busy haunts of men, can easily find one, but in settling there he must give up schools, and churches, and mail facilities, and social privileges. If these things are too valuable to him to be sacrificed, he must be content to live near other people and give up the idea of a home in the wilderness. If a farmer is determined to grow sugar-cane, he must go where the growing season is very long and extremely hot. If he does not like and will not endure the heat, he must give up the idea of growing the cane, for it is utterly impossible to grow this plant in a cool climate. If he wants to produce a large quantity of maple sugar, he must locate where the nights, even in the spring time, are so cold that the ground will freeze. Otherwise his efforts will be of no avail. The same principle governs everywhere. No location can be found in the civilized world but what has certain advantages, and there is none so favored that it has no drawbacks. The *sum* of the advantages in one locality may be greatly in excess of the sum of those presented by another, but the poorest of all places in which a man can live will be likely to have something to recommend it which more favored localities do not possess. The farmer should always keep the fact in mind that there are drawbacks everywhere. By chang-

ing his location he can escape the difficulties with which he is now beset, but it is absolutely true that he will find plenty of other things to make him trouble. Perfection, either of character or location, is not to be found in this world. The mere fact that things are not just to his liking where he is, does not furnish proof that he will find relief from his difficulties by a change of place. In many cases it is a change in the methods of doing business which is needed. This a change of location would not secure. Many a man is spending a great deal of time, indulging many useless longings, and building many castles in the air, and imagining that if he were only somewhere else he could do a great deal better than he has ever yet been able to do, whose eyes are closed to splendid opportunities for making money on his own farm. These men are not doing very well—never have done very well. They are dissatisfied because they do not get along any better, and think it must be all owing to their unfavorable location. The truth of the matter, in many of these cases, is, that these farmers do not understand the resources of their own farms and do not see the opportunities which are constantly running to waste. They fail to realize that the present is the one grand opportunity which God gives to men, and that, as a general rule, those who fail to improve where they are would do little, if any, better if they were differently located. Success on the farm depends far more upon a man's character than it does upon his surroundings. If he has no energy, and skill, and judgment, he will remain poor on the best farm in the world, while, if he possesses these qualities, he will be reasonably successful under adverse circumstances. Now every man has his character, and this character will be likely to stay with him wherever he goes. If a man is energetic and industrious at the East, he will be likely to exhibit these traits if he goes West to live; but if he lacks these elements of character at the East, merely going West will do nothing to secure them for him. If he manages a New England farm by

sitting in the village store, or the blacksmith's shop, while his boys do the work, or it remains undone, he will be very sure to do just the same with a Western or a Southern farm, if he should ever obtain one.

It is a fact which should be impressed upon the mind of every farmer, and every farmer's boy, that mere change of location does not and cannot, never did, and never will, change the character or the disposition. It is very important to keep this in mind. It will not only counteract a false idea which has taken possession of many minds, but it also furnishes the key to a solution of the problem which is under consideration. The man who is restless, dissatisfied, and eager for a change of some kind, anxious to get away from where he is, but having no definite idea where he had better go, thereby acknowledges that there is something about himself which is wrong. It has been shown that location cannot change the character—cannot make a different man—therefore it follows that the difficulty is not with the location, but with the man himself. The true remedy is not a removal but a reconstruction. Instead of going away from his old home and friends, let the dissatisfied farmer take a calm view of the situation, look the truth fairly in the face, and find just where the trouble lies. He will probably find one or more of three difficulties. Either he does not get along well with his work, his crops are poor, or his income is not sufficient to meet what he considers his necessary expenses. Now removal to a different part of the country is not the proper remedy for either of these troubles. If a farmer cannot get along with his work where he is, he cannot manage it satisfactorily anywhere else. His true remedy for this difficulty is to carefully study how he can do his work to better advantage. A little thought will enable many a farmer to see how he can save a great deal of useless labor, and how he can make available much of the time which does not seem to yield a return. If he would study to make the most of his opportunities, and do everything to the best advantage, he

would be enabled to accomplish a great deal more with the same amount of time and labor. But if the difficulty is not due to this cause, if the work can be managed well enough, but the results are unsatisfactory, if the crops are light and unprofitable, there is no call, on this account, for leaving the present location. Good crops do not produce themselves. Even on rich land the farmer has something to do to secure large returns. The farmer who can grow paying crops in one part of the country can do the same in any other section, while he who fails in one place will be very sure to fail elsewhere. Consequently, removal is not a remedy for the difficulty now under consideration. The true course for the farmer who is suffering from this cause is to study the requirements of the various crops, learn which are the best fertilizers, and how to apply them, the best methods of culture—learn these things and put them in practice. When he does this his special trouble from this cause will vanish. In case that the farmer succeeds well with his work, obtains good crops, but still does not get along because his expenses exceed his receipts, removal is not at all in the line of what is needed, and will not make him successful. Here the trouble is with his business habits. Either he does not understand selling his crops and buying supplies, or else he does not practice economy in his purchases. In either case the remedy is to be found in a careful study of business principles, and a determination to live within his income, even though much self-denial may be required. One of the great difficulties with a multitude of farmers is that they do not understand doing business. It is one of the things in which boys on the farm should be instructed, and which the farmer who is deficient therein should make his careful study. The earlier in life these principles are mastered the better, but it is "never too late to mend," and a man is never too old to learn.

Such are some of the difficulties with which many farmers contend, and such are the remedies therefor. The difficulties

are of an internal rather than an external origin and nature. They are inherent in the men and not in the business which they pursue. They can be overcome without a change of location merely by a change of practice. Not only is no change of locality demanded, but in many respects it would impose an additional burden upon the farmer. If he removes to another section of the country he will be to considerable expense, lose some time in going, and much more in learning the habits and customs of those among whom he locates, and it will take a long time for him to become thoroughly familiar with the character and capacities of the soil, and the best methods of its cultivation. Thus, at the very outset, he is placed at a great disadvantage, and finds himself much worse off than he was in his old location. As a general rule we like the idea of handing down a farm from father to son through successive generations. It is better to keep a farm "in the family" than to be constantly roaming around. If properly managed, money can be made on the old place, and more happiness can be secured there than elsewhere. The associations which gather around the homes of the fathers become sacred to the younger generations. The tendencies of these associations are to restrain from evil, and to incite to good thoughts and deeds. Farmers should be slow to part with the "old homesteads," not merely because of their own attachments, but also on account of the influence upon their children. Of course, not all the children can remain at home: some must go out into the world and settle other portions of this great country. But enough should remain to keep the old farms under cultivation, to sustain the institutions which their ancestors founded, and keep the graves of the fathers green. This is not merely a matter of sentiment. Money is at stake. More than this; the progress of religion and the permanence of our free schools are largely dependent upon the retaining of the homesteads by those who have the same interests which our forefathers labored

to preserve. In some parts of New England the native population has, in a great measure, withdrawn. Many of the smaller farms are in the hands of foreigners. Others are deserted, and the land has been turned into pastures. If the process goes on much longer there will be many towns in which the foreign vote will decide all local elections. The new-comers are generally kind neighbors and industrious people, but the majority of them are not in sympathy with our free schools, they do not believe in our religion, they have no desire for, or faith in, intellectual progress, and they will not make these towns centres of thought and influence. Agricultural societies will receive no help from these inhabitants, and an intelligent and progressive system of farming will not be pursued. There should enough Americans remain to control town affairs, and to cast the town influence in favor of right and progress. On the same principle the homesteads of the farmers at the West and South should be kept in the hands of Americans, and as far as possible, in the families to which they now belong. Room should be made for foreigners who are willing to come among us and obey our laws, they should be kindly treated, and should be encouraged to do well; but they should not be allowed to supplant American institutions, or to come into possession of our present homes.

That it is harder work to cultivate some of the stony farms in New England than it is the fertile plains of some of the Western States is very true. And it probably is easier, as many assert, to take a new farm on the frontier, than it is to restore to its original fertility one which has been exhausted by a bad system of cultivation. But the great law of compensations, to which attention has been called, here comes into play; and when all things are taken into the account, there will not remain a balance in favor of the pioneer. Still, some must go out from our homes to people the wilderness and establish churches and schools. Their mission is a noble one; and, if faithful, they will not fail of their reward.

Thus far the question of location has been considered with reference to the owners of land. The same question presents itself to those who labor for others. They can change their location with less trouble and expense than men who have capital invested in real estate. If there are no special ties to keep them where they are, they should determine to work where they can receive a fair compensation for their toil, and also do the most good to other people. There are thousands of men, many of them young men, in each of our large cities who are not needed there, are not wanted there, and for whom there is no room. They choke all the avenues to professional and business life, and by excessive competition are constantly injuring themselves and all with whom they have to do. But in many places at the West and South both native and foreign laborers are in great demand. If the farmers' sons who have crowded into the cities in hope of finding more profitable or more congenial employment would go back into the country, where they are needed and rightfully belong, the exodus would prove an immense benefit to themselves, their new employers, the cities which they leave, and the towns to which they would go. In some sections of the country, notably in some parts of New England, there is already a surplus of farm laborers. Those who have no families dependent upon them, and no special call of duty to remain, might help themselves and others by going where their services are in greater demand. Whether they should go West or South should be made to depend upon the call for laborers, their own wishes, and the special line of business in which they would like to engage. If they desire to take care of cattle they should go to the Western States, or to Texas; while if they would like to learn the processes of cotton-growing they should go to the Southern States, in which that industry is prominent. By occasional changes of location there will be an opportunity to learn a great deal concerning the soil, products, methods of culture, and general characteristics of different parts

of the country. But much of this very desirable knowledge can be obtained by reading, and the restless spirit which frequent changes encourage must not be allowed to become dominant. A rover is not usually a good farmer. Though he may know something of many branches, he will be master of none and will be an inefficient laborer. Besides, an established reputation for honor and integrity is very valuable, but it can only be secured by remaining with people long enough to enable the parties to become thoroughly acquainted. It is better both for the employer and the employé that they remain together for several years. Too frequent change of location indicates an unstable character and a discontented frame of mind.

Such are some of the general principles which should have an influence in deciding the farmer's choice of a location. As there are exceptions to all rules, so there will be exceptions to the general application of these principles. On account of the ill health of a farmer, or of some member of his family, for which a change of climate seems to be the best, if not the only remedy, it may be much better for him to leave his present home than it will to remain. There are also families—some may be found in every section of the country—who for generations have stood at the foot of the social scale. The present members of these families feel that they have little encouragement to attempt to make any improvement where they are. Yet there are some who would be glad to do better and work their way up to social recognition. If they could get away from the old acquaintances who have always despised them, and the evil companions who constantly try to keep them down to their own level, and locate where they are not known and their past bad name would not affect them if they conducted themselves properly—where the cost of living is small and labor is fairly rewarded—they might reform, and become able not only to respect themselves but also to win the respect of others. They would carry their old characters with them, it is true, and

their improvement would be only gradually effected, but they could be no worse off for going, and some of the principal influences which have tended to keep them down would be removed. Freed from old companions, thrown upon their own resources, made in some degree to feel their own responsibility, and coming in contact with strangers, the result of the change would be highly beneficial. The young people especially would feel the force of the new surroundings, and might make rapid advances in knowledge and in business skill and management.

There are also men belonging to the better classes who have a strong desire to engage largely in a certain line of farming for which they have both taste and skill. In order to gratify this desire they will be obliged to leave their present homes. In many cases it may be well to gratify the wish, while in others it should be stifled. The farmer has a duty to his family, as well as to himself, and could not be justified in depriving his wife and children of too many privileges in order to secure his own advancement.

In any and every case, before leaving his present home for another location, let the farmer carefully consider the question whether, on the whole, it will be any benefit for him to make the proposed change. Let him remember that wherever he goes he will be obliged to submit to many discomforts, that there are drawbacks everywhere, and that, in order to retrieve the failures of the past, a change in the methods of managing his business is needed far more than a change in his location. Let him consider his present privileges and opportunities as well as the unpleasant circumstances which trouble him. The best interests of his family should be considered, and the whole subject should be examined in all of its bearings. If, in a majority of cases, a decision not to remove should be reached, we think the parties interested will have no occasion to either be ashamed or to regret their choice.

LARGE OR SMALL FARMS.

IF farmers were in the habit of following the principle embodied in the old tailor's plan of cutting a coat large or small according as there was a large or a small supply of cloth for the purpose, there would be no necessity for a consideration of this subject. But, as a class, farmers are not in favor of applying this traditional method to the management of their business affairs. This is especially true in regard to buying land. Instead of limiting their purchases by their means they too often buy to the full extent of their desires. Many are more ready to buy land on credit than they are most other things because they have an idea that they can make the land productive enough to pay the interest, meet all the expenses of cultivation, and make an annual reduction of the principal. The fact that a multitude of farmers have made this attempt, and been wholly unsuccessful, does not seem to deter others from making the effort. To many men there is a sort of fascination in buying land, which they do not resist, and which leads them to financial ruin. These men seem to think that because it is a good thing for a man to have a little land it must be much better for him to have more—a very simple line of reasoning but one which often leads to bad results in practice. There is such a thing as having too small a farm; but the tendency with American farmers is to go to the other extreme and buy too much land. The fact that one man has been very successful in the management of a large farm is not a good reason for supposing that any other man will be equally successful if he can obtain as large an area of land. Some men have special talents for the management of great operations. They have good judgment combined with a large degree of executive ability. They think quickly, and are both energetic and skilful in action. They have peculiar abilities, with which the majority of men have not been favored, and which qualify them for the management of

large estates. But there are many men who do well on farms of moderate size who could not manage large ones profitably. This question of ability is of very great importance. It should be considered first in order when the question of a large or a small farm is to be determined. We give it preference even to the pecuniary condition in which a man may be placed. For, if a man has in a special degree the peculiar ability necessary for the management of a large farm, he can go in debt for one and make his business a success, while a man who is deficient in this respect may have plenty of money with which to buy a large farm and still not be able to make it pay the running expenses of its cultivation.

The section of country in which the farm is located will also have much influence in determining its size. At the EAST, where land sells for high prices and is hard to cultivate, smaller farms should be bought than at the WEST and SOUTH, where land can be had for lower rates, and where, by the use of improved machines, one man can cultivate as much land and produce as large crops as three men can manage in NEW ENGLAND. At the WEST and SOUTH, where the prices of produce are very low, it is necessary that the farmer should secure larger crops than the Eastern farmer grows. Otherwise, the income from his farm would neither pay the interest on his land nor support his family. The WESTERN farmer who sells corn for twenty cents a bushel needs to grow a great deal more to obtain a certain income than the New England farmer who sells for eighty or ninety cents.

The amount of help which the farmer has, and the particular line of farm business which he designs to follow, should also be determining elements in deciding the size of a farm. If he has several boys who are large enough to work, and who like farming, he can safely buy a much larger farm than he can if he has no one to help him. If he designs to grow corn, wheat, and other crops which require considerable working of the land, the

farm should be smaller than one devoted principally to the growing of live-stock. There is neither economy nor safety in buying land which cannot be put to some practical use. Although real estate has long been considered one of the safest forms of investment, the experiences of the past few years have proved that even with this there is danger of overloading. Many a man has lost a fortune because his money was locked up in real estate which was not productive, which he could not sell, and on which he was constantly obliged to pay heavy taxes. In good times some men have made money by buying land and holding it for an advance of prices. But many lost instead of made; while, in times of financial depression, multitudes have been utterly ruined by having too much land and too little money with which to hold it. It is an eminently safe course for a farmer never to buy land which he does not need, and which he cannot make immediately available.

That there are certain advantages in having small farms cannot be denied. They require less capital, less hired help, less teams and tools, and there is less care and anxiety about their management than is the case with large ones. Many a man can buy a small farm, cultivate it well, himself and family doing all of the work, and obtain crops enough to make them comfortable. If he gets the idea, as many men do, that he must get rich, and that in order to secure this end he must have a great deal more land, the chances are that this pernicious idea will run away with him, and that his days of happiness are passed. The farmer who is doing well, who can comfortably support his family, and educate his children, should be thankful that he is so highly favored. Still, he should not sink into idleness and inefficiency, but should make the most of his opportunities. By giving more thorough culture he may be able to increase the amount of his productions, and thus add to the profits of his business. But there is no necessity for the purchase of more land. And in the great majority of cases the owners of medium-sized farms can do a

great deal better by improving their methods of culture, and choosing more profitable crops, than they can by enlarging the area under cultivation. Yet there are some men—a great many in all—who do not have land enough, and who can make it pay them well to increase the size of their farms. But the average American farmer does not err in this direction. He goes toward the other extreme. He buys land without carefully considering whether he really needs it, and can make it a source of profit.

While there are some things which point to small farms as the most profitable for the average worker, there are also manifest disadvantages connected with them, and certain respects in which larger farms are the most profitable. The cost of buildings which are needed on a large farm is but little more than the expense of those which are required on small farms. In the older States a farm of sixty acres should have at least fifteen hundred dollars invested in buildings, while on a farm of one hundred and eighty acres but little, if any, more than two thousand dollars will be needed for this purpose. The house for the small farm will do well enough for the large one. The barn, wagon-shed, and granary for the large farm must be considerably larger than will be needed on the small one, but the cost of these buildings is comparatively low, and the necessary increase of size will not involve a very great additional expense. But it *will* make a great difference in the profits of the business whether a large or a small proportion of the capital invested is put into property which is not directly productive. This is a matter of great importance, and should be considered with care. Suppose the land to be worth fifty dollars per acre. Then we have, as the cost of the small farm, sixty acres of land worth three thousand dollars, and buildings worth fifteen hundred dollars—a total expense of four thousand five hundred dollars. The large farm has one hundred and eighty acres of land worth nine thousand dollars, and buildings worth two thousand dollars—a total cost of eleven thousand dollars.

The large farm costs less than two and one-half times as much as the small one, but it contains three times as much land, from which an income can be obtained. With money at six per cent., the interest on the large farm would be six hundred and sixty dollars per year, while on the small one it would be two hundred and seventy dollars. Here the expense is less than two and a half times as large in the case of the large farm as it is on the small one, while the productive power is three times greater. On the small farm one-third of the whole capital is not only producing nothing, but is a constant source of expense. Interest, insurance, taxes, and repairs will be constant outgoes, of which the land must bear the expense. On the large farm the proportion of this unproductive property to the whole capital is only two-elevenths. On the small farm the interest equals nine per cent. on the value of the productive property, while on the large farm it is reduced to seven and one-third per cent. These are very evident reasons why many men who have bought quite small farms have not been as successful as they hoped. They have put too large a proportion of their money where they receive no direct return.

There are some other things, closely connected with the above, in which the large farm has the advantage of the small one. As a rule the taxes on a farm which is nearly all productive property are lighter in proportion than they are where much of the capital is invested in buildings. The fencing of a large farm can be performed at much less proportional cost than will be possible on a small one, and the labor of cultivation can generally be managed much better in large than it can in small fields. The cost of tools for a small farm is very much higher in proportion to the work done with them than it is on a large one. We have known many farmers who cut only fifteen or twenty acres of grass each of whom had a mowing-machine, a hay-tedder, and a horse-rake. These machines would have done all the work required of them on farms three times as

large, and would have lasted a great many years. If only a few acres of grain are produced, the farmer needs plows of different patterns, harrows, planters, cultivators, and harvesters. For these he has to pay just as much as the large farmer who can get from three to six times as much use from them. The small farmer does not require quite as many tools in number as the large one, but he is obliged to buy a great many for which he has but comparatively little use, and the total cost of the implements which he needs when compared with the total value of the crops which he grows is many times larger than the expense incurred by the large farmer. To some extent, though in a somewhat less degree, the same is true of the cost of teams for the performance of farm-work. Another disadvantage of a small farm may be found in the fact that its owner is obliged to do a very small business—a business not small merely in the aggregate but exceedingly small in its details. He may have many things for sale, but they are in such small quantities that buyers will not come to him to purchase, and he wastes much time in carrying small quantities of produce to market. It is just as much work, takes just as long, and requires a team just as much, to take five hundred pounds of straw to a customer as it does to take fifteen hundred pounds. The work of loading and unloading is a little greater in one case than the other, but the cost of weighing and the other expenses are just the same, while the money received for the large load is three times the amount of that obtained for the small one. It takes just as long to go to market with ten pounds of butter as it does with one hundred, but there is a great difference in the amount of money received. When the farmer has to go to market every week with a small quantity of produce he spends much time for which he receives but little pay. He could just as well carry three or four times as much, if he had it, and then there would be a nearer approach to profit in the operation. If a man produces a large quantity of anything which is in

demand, buyers will call on him, and a sale can be effected without spending much time; but if the quantity which is produced is small, the grower must go where the buyers are. The man who has a large farm ought to have a large quantity of products, but the small farmer cannot be expected to produce very much of any one thing. In many neighborhoods the small farmers might profitably arrange so that one of their number should go to market each week and carry the produce for the whole company. By taking turns each one would bear his rightful share of the burden, while he would save a great deal of time and trouble. But even here the large farmer would have the advantage. All the products would be his own, he would be able to judge accurately of their quality, and he would feel at liberty to sell for any prices which to him seemed best. Still by means of the co-operation suggested above, the advantage of the large over the small farmer would be reduced to the lowest point.

"Last, but not least," we must consider the question of capital as affecting the size of farms. This is an important point, though, as already suggested, it is far from being the only one which should receive attention. In order to buy a farm safely and manage it successfully, a man ought to have some money at his command. That some men have bought farms almost wholly on credit, and then got trusted for the stock and tools which they needed, who have eventually succeeded in paying their debts, and thus becoming the owners of the property which they had nominally held, is true, but they are exceptional cases, and should not be taken as examples. Unless a man can pay quite a proportion of the purchase-money, he had better work for another, or else hire a farm, than to buy. Few conditions in civilized life are more pitiable than that of a man who has invested his little all in a farm, worked on it many years, and when old age is coming on, finds that he can hold it no longer. A slight depreciation in the price of

real estate often swallows up the entire capital of men who have bought farms largely on credit. In many instances these men have made extensive improvements on the land, but by reason of ill-health or loss of crops are unable to keep up the interest, and the mortgages are foreclosed, leaving the farmers and their families without a home. It is much pleasanter to own a farm than it is to work for another man, but it is not as safe a thing for a poor man to do. On this account we would not advise the buying of a farm without considerable ready money.

While a man who is qualified for the position can do better on a large farm than he can on a small one, and much of the business of a large farm can be managed to better advantage than that of a small one, there is altogether too much risk in buying a large farm, or enlarging a small one, on credit. Better incur the extra expenses of a small business than run the risk of losing everything in a large one. It is often quite easy to figure out a profit in the operation of buying a large farm, but when it comes to working it out the case seems very different. In estimates on paper the expenses are usually put too low, and too little allowance is made for unfavorable seasons, damaged crops, low prices, sickness, accidents, and other losses which, to some extent, almost every farmer is obliged to sustain.

Although in buying a farm it is desirable to pay as large a proportion of the price as possible, it is not wise for the purchaser to invest *all* of his money in land. He needs a team, and tools, and stock; just as much as he does land, and it is better for him to pay for these and get more credit on the farm, than it is to pay a larger part of the purchase-money for the land, and run in debt for small amounts at several different places. It is bad enough to be in debt to any one for any purpose, but it is better to have the debt in one large amount, in one place, than to have an equal amount of indebtedness scattered in many different places. These smaller purchases

can be made to much better advantage for cash than they can on credit; the buyer will be more careful in making his trades if he pays down for all that he buys; if his indebtedness is all in one place he will know exactly how much he owes, and will not be in danger of forgetting many little items, while the general influence of the transaction, both in its present and its future bearings, will be much more favorable to his permanent success if he avoids small debts entirely, and incurs large ones with extreme caution.

Such are some of the principles which should be regarded in determining the size of farms. Many other things, of smaller importance but still worthy of regard, will enter into the account. Circumstances should be considered and duly weighed. Common sense should be used and allowed to lead to, or to modify, conclusions according to its own dictates. But it will be well to always remember that a large farm involves a great deal of care and responsibility, and that a large debt, for whatever purpose it has been incurred, will invariably prove a heavy and a tiresome load.

FARM BUILDINGS.

IN order that its business may be managed in an economical and successful manner, and that the comfort and welfare of the farmer and his family may be secured, it is absolutely necessary that there should be several buildings upon each and every farm. The exact number which will be required will depend upon various circumstances. The size of the farm, productiveness of the land, and the special department of business which is carried on, must be considered. But there are a few particular buildings which each farmer absolutely needs. Of these, the house is the most important, and is usually the most expensive. In our variable climate, with its frequent and sudden changes and its great extremes of heat and

cold, houses are indispensable to the comfort and health of the people. In large sections of the country there is also a necessity for providing shelter and protection during several months in each year for domestic animals. On this account, and also to provide a place in which food for their sustenance during the winter can be kept, barns must be furnished. On farms which to any extent are devoted to the growing of the cereals, a building, called a granary, should be provided for the safe storage of these valuable products. There should be a small house for the hogs, and another for the sole use of the hens. A shed close to the house should be used for storing fuel, while another, and larger one, should shelter the wagons, carriages, farm implements and machines, when they are not in actual use.

As has already been suggested, it is a strong objection to small farms that the cost of the necessary buildings bears a very high proportion to the value of the whole farm. But it is an objection which the owners of small farms cannot avoid. If they have the farms they must also have the buildings. Some farmers attempt to mitigate the evil by making one building answer the purposes of two or three. They make the barn serve also for a granary and a hog-house. The wagon-shed shelters both the wagons and the hens, and the wood-shed is merely a back room in the house. In this way the cost of farm buildings is greatly reduced, but the plan cannot be commended. Low cost is an item of great importance, it is true, but it is not the only thing which should receive attention. There must not only be something in the form of buildings, but, if the business is to be made profitable, these buildings must be so constructed and arranged as to answer the purposes for which they were designed. In order to reduce the cost of a farm it is not wise to attempt to get along without things which the experience of generations of farmers has shown to be absolute necessities. When a choice of evils is given we ought always to choose the least. Consequently, although the cost will thereby be some-

what increased, we believe in having a separate house for the hogs, another for the hens, a wagon-shed devoted, as far as the ground floor is concerned, to the one purpose of storing wagons, and a granary in a building distinct from any other. We favor this arrangement on the principle that no man can work advantageously without having something to do with, and having things convenient for the management of his business. In the long run it is not profitable to try to get along without suitable buildings in which the in-door part of the work can be carried on. If a farmer keeps hens, he ought to furnish a house in which they can remain undisturbed. If he keeps hogs, he should provide a building which is adapted to their special wants. Whatever kind of stock is kept there should be conveniences for caring for it, and the surroundings should be so arranged as to make it a source of profit to the owner. To the general rule, that without room and without conveniences for carrying it on, no kind of business can be made to pay, farming is not an exception. Economy on the farm is a good thing if it is properly directed; but when it leads the owner to do without suitable buildings it proves an unsafe guide. Such a saving is like the course of a man who should put only one kernel of corn in a hill because he wanted to prevent an undue expense for seed. Instead of leading to success, such a course would involve an utter failure.

The size of the farm should, to some extent, govern the number and should regulate the size of the buildings thereon. The house, however, should be governed more by the size of the family of the owner, and the amount of help which he designs to keep, than it should by the size of the farm. But the size of the barn, the granary, and the wagon-shed, should be proportioned to the amount of land cultivated and business performed. When farms are extremely large it is sometimes better, as well as more convenient, to have two or more barns and granaries on different parts of the farm than it is to have only one building, and that

one excessively large, devoted to each purpose. In addition to the buildings needed upon a small farm, the owner of a large one should have a tool-house, in which to store his farm implements and machines when they are not in actual use, a repair shop, in which worn or broken tools can be put in order, and little jobs of carpenter work, which are so often needed on the farm, can be performed, and also a building to be used for the purposes of a general storehouse. If any special kinds of business, not included in ordinary farming, are carried on, it may be necessary to erect buildings in which these industries may receive attention. Where many cows are kept, and there are no butter or cheese factories in the vicinity, or it is not thought best to patronize them, a milk-house will not only prove a great convenience, but will also be a great help in the profitable management of the dairy. On farms where tobacco is one of the standard crops, buildings for drying and curing it will be required. In the production of flax, or hops, or the manufacture of maple sugar, and other industries of a similar nature, special buildings may be required for the particular kind of business which is added to the ordinary work of the farm.

LOCATION.—This will have a powerful influence upon the happiness of the farmer and his family, and it is, therefore, a matter of very great importance to have the buildings properly located. If the house is far back from the road, and the kitchen and sitting-room, as is too often the case, are in the farther corner of the house, it will be a difficult matter for the wife or the children to be happy, or even contented. The farmer and his grown-up boys will not mind this enforced retirement as much, because a large portion of their time is spent in the fields, but they will fail to receive the cheer and sunshine which a better location of the living rooms would insure, and all who live in the house will suffer from its too great isolation. For many reasons a house in a village is not desirable for a farmer, but the location should be near a road where there is, at least, an occa-

sional passing team and where all the inmates of the house can often see men and women from other families. It is possible to have the house too near the highway, but many farmers go to the other extreme, and locate their homes in the fields instead of near the road. To this undue isolation, together with hard work and poor health, the latter in a great measure caused by the monotony of a retired life, much of the insanity among farmers' wives can be directly traced. If there are but few companions, if no strange faces are seen, and a ceaseless round of duties must be performed, there is danger that the mind will prey upon itself, and lose its balance and power. The tendency in this direction may be, to some extent, counteracted if preventive means are at hand, and are employed before the mind becomes diseased. But this does not make it any less the duty of the farmer to choose the brightest and pleasantest location which he can find for his home. Even if terrible evils are avoided, an unduly isolated life is not as happy, and will not be as useful, as one spent under more favorable circumstances. It may seem a little matter whether a house is located near a road or ten rods away from it, but it makes an immense amount of difference with the happiness of the inmates. Even though no word is ever spoken to a passer-by, it makes life more cheerful to see an occasional team, and to have the evidence of the senses that other men and women are living and moving in the world.

We have no hesitation in expressing the opinion that one of the great requisites of a good location for a farm-house is proximity to a travelled road. This being secured, it is desirable that a dry and slightly elevated plot of ground should be obtained. In a great many instances this can easily be secured on some part of the farm lying near the highway. But in some cases the land is flat and wet, and there is no good site for a building on the whole frontage of the farm. In these instances skill and labor should be made to overcome natural obstacles. The best location which can be found should be chosen and

thoroughly drained. When this has been accomplished, the cellar should be dug, a good wall laid and raised considerably above the surface of the surrounding soil. A sufficient quantity of earth should be carted and spread around the house, to give an elevated yard from which the water will readily flow, thus insuring dry and pleasant surroundings as far as the immediate vicinity of the house is concerned. There are but very few farms upon which a good building-spot cannot, in this way, be obtained.

It is also very desirable to have a dry and warm location for the barn. Though this should be secondary to the location of the house, it is a matter of considerable importance to have the barn, and other farm buildings, on good sites and properly arranged. The work of the owner will be greatly helped by a suitable location of these buildings, or hindered by a bad arrangement of them. The barn may be so located as to cause a great deal of unnecessary travel, thus involving a waste of time and strength, neither of which the ordinary farmer can afford to lose. If placed where the barn-yard will be muddy every time it rains, there will always be reason to regret the choice of the site. Merely the annoyance and inconvenience of having to walk through the mud, as the farmer will often be obliged to do in warm weather, will become, in time, a heavy burden. It is no great matter to walk once through a muddy yard and then clean the boots or shoes. But when it comes to going into the mud many times a day and many days a week, it will be found very unpleasant, and, in the course of a summer, considerable time will have been spent in the effort to get off the mud which was loaded on the boots or shoes. Most farmers could devise fully as pleasant an occupation, and it is certain that work which would prove more profitable might be found upon every farm. But this is not the worst difficulty with a wet yard. If the manure which the yard contains is constantly saturated with water, much of the plant-food, which it ought to

furnish to the crops, will be leached out and wasted. Upon some farms a very heavy loss is sustained every season from this cause alone. Then, too, the labor of the teams in carting it to the fields, and the work of the men who load and unload the water-soaked material, will be increased from one-third to one-half, and in some cases in a still greater proportion, thus making a great waste of time and strength. When wet manure is carted upon the farm, its weight causes the wheels to cut into the turf, thus greatly increasing the draft of the load, and seriously injuring the mowing lots and grain-fields across which it is drawn. Other objections might be named, but the ones already given should be sufficient to deter the farmer from placing his barn upon a wet site if a dry one can be secured. When the best location on the farm is wet, the owner must make the best of a bad matter. The land chosen for the site should be thoroughly underdrained, the barn set up a little above the surrounding level, as directed for the house, and the yard should also be slightly elevated. The same general rules should be followed in the selection and fitting of a location for the other farm buildings.

But in the effort to secure dry yards and good drainage, the owner should not place any of his buildings very far from the road, or on a steep hill-side. Since this chapter was commenced, we called upon a farmer whose house and barn are nearly at the top of a large and steep hill, and are reached by a slanting road some twenty rods in length. Such an arrangement of the buildings is very inconvenient, and is a great objection to a farm. It is not wise to build so far from the highway, and not at all pleasant to be located on such a steep side-hill. A steep hill must always be a very objectionable place upon which to build a barn. For, if the barn is near the top, most of the hay and grain must be drawn up the hill, while if it is near the foot these crops can be drawn down; but nearly all of the manure must be carted up the grade. No one needs to be told that it is

hard work for a team to take a load either up or down a steep hill, or that it is much more difficult cultivating a hill-side than it is a level field. While it may sometimes seem best to use these hills for cultivation, it is often better to convert them into pastures, and find some more level place upon which to erect farm buildings. In all cases, before finally deciding upon a location, much careful thought should be given to the subject, and the best possible place on the farm should be selected.

If the buildings were already located before the present owner came into possession of the place, and he finds that they are not where they should be, the question of moving them to better sites should be considered. It is a somewhat expensive operation to move farm buildings, and the work should not be attempted without good reasons exist for making the change. But when the reasons are sufficient to justify the course, and the means of paying for the work are at hand, there should be no delay in effecting the change. We do not advocate such a change merely on the ground of appearances, though, if a farmer has plenty of money, it will not be an altogether useless expenditure, either of time or means, to arrange his buildings so that they will present a beautiful appearance. The rich man can afford to do considerable in the way of improving the looks of his buildings and surroundings. But in the cases in which we recommend the moving and re-arranging of their buildings by farmers of moderate means, we make the suggestion for the sake of securing happiness to the family, a greater degree of economy of labor, the saving of the strength of men and teams, and the prevention of the waste which otherwise will inevitably occur.

We would not advise the removal from one location without a certainty of improvement in another place. Farmers have been known to move from a site which did not give entire satisfaction, and find, when they had got settled in the new place, that it was not as good as the old. In avoiding a hill-side, some farmers have built close by the bank of a stream. When the

water was not unusually high, all went well; but when heavy rains came, when the stream overflowed its banks, their cellars were filled with water, and their gardens and door-yards covered with sand and gravel, they found there were inconveniences in the new location as well as the old. These locations upon the banks of streams are not always the most healthful, as there is frequently a great deal of fog in the morning, which, with the dampness of the evening air in such places, is injurious to people whose lungs are weak or who suffer from neuralgia or rheumatism. A location which is not exposed to the gales which so often sweep over high hill-tops, and which is also free from danger by overflowing streams, is far more desirable than either of these can be made.

RELATIVE POSITION.—Thus far we have spoken of the general location of farm buildings. We ought also to consider their location with reference to each other. The house should have the most prominent position and the best location. With the front view from the house no other buildings should interfere. Neither should any of the buildings be so located as to cut off a view of the road from either the kitchen or the sitting-room windows. Very few farmers would think of putting the barn directly between the house and the highway; but there are many farms where some of the buildings obstruct the view from the windows. There is no necessity for this, and, as long as it interferes with the comfort and pleasure of the family, while answering no possible purpose for good, it should not be allowed in the location of new buildings. Whether it will pay the farmer to remove those which are already located will depend upon his financial condition, and also upon the peculiar circumstances of the case. It is a great deal easier and cheaper to locate new buildings just right than it is to remove old ones and place them where they ought to stand—a fact which is very evident and which should be kept in mind by farmers when they are choosing new locations.

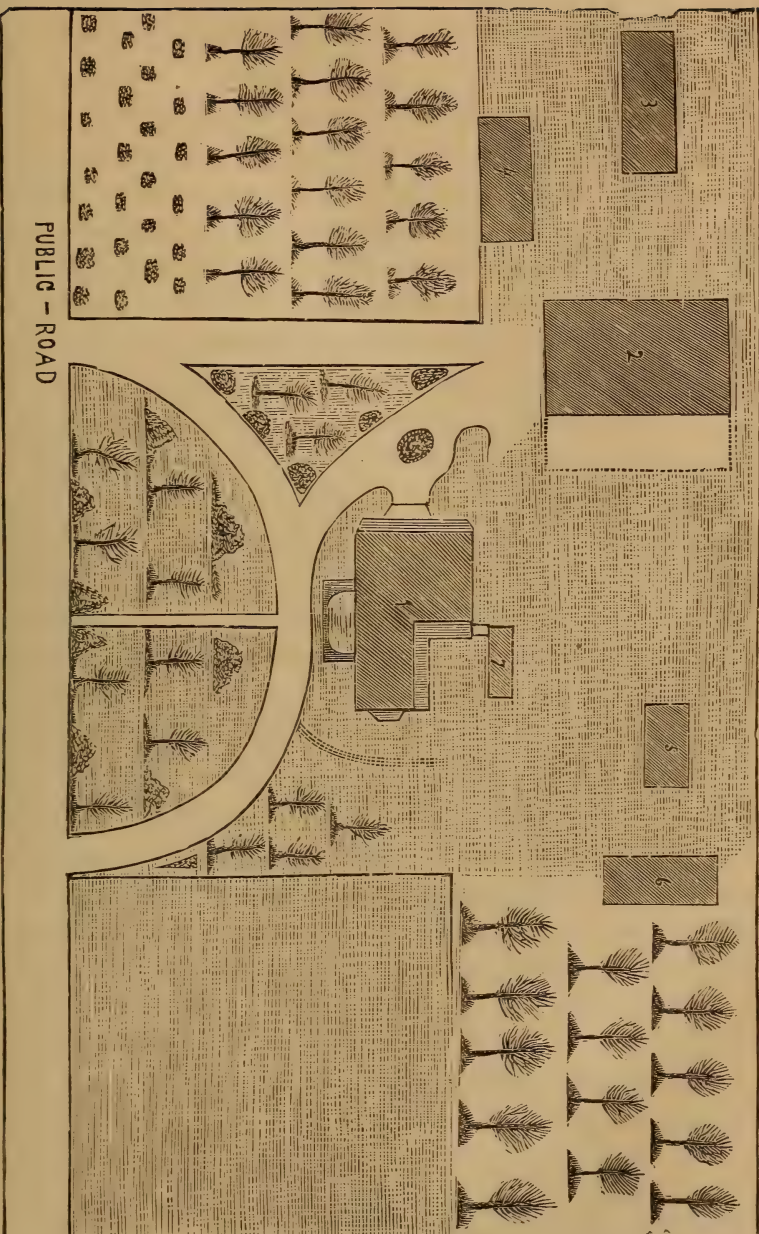
Taking care to give the house a prominent and, as far as the highway is concerned, commanding position, the attention should next be directed to a location for the barn. This should not be so near the house as to permit the offensive odors of the stables to trouble the family or allow the drainage of the yard to reach the well. On the other hand, the barn should not be so far from the house as to make a great deal of unnecessary travel in going from one to the other. In bad weather, and especially when there is a great deal of snow on the ground and paths have to be shovelled, it makes a great deal of extra work to have the barn a long distance from the house. Besides, the distance furnishes an excuse for hired men, or boys, who may be disposed to be negligent, for not attending to the cattle as they ought.

The granary should be near the barn in order to save the work of carrying the grain a longer distance than is necessary. It makes a great difference with the work of carrying the corn from the barn, where Northern farmers husk it, to the bins in the granary, whether these buildings are within ten feet of each other or are four rods apart. In the ordinary methods of farming at the North, there must be a great deal of passing from the barn to the granary and back. If these buildings are far apart there will, in the course of time, be a great amount of work and travel utterly wasted. This fact has been so evident to some farmers that they have had a room for the granary finished off in the barn, and thus kept the two under one roof. To this plan there are some objections, and it has not met with general favor. It is not convenient, perhaps not possible, to give as free access of air and as thorough ventilation as is needed to secure the rapid drying of the grain. Rats, too, are likely to be much more troublesome if the grain is kept in the barn than they are when it is stored in a separate building. This is because they almost invariably congregate about a barn, and also because, when the granary is a separate building, precautions against their inva-

sions can be taken which are not possible when a room for the purpose is done off in the barn.

The location of the wagon-shed also claims careful thought. If it is correctly chosen, the farmer will be able to do much of his work to better advantage than he otherwise could. Here, as elsewhere, convenience is a matter of a great deal of importance. The idea which some farmers seem to entertain, that it is unwise to attempt to save labor, and that such an effort is a sure sign of laziness on the part of the one who makes the trial, is utterly wrong. The farmer ought to try to save labor just as truly as he ought to be careful in his expenditures of money. In reality labor is equivalent to money. The money value of an article is in a great measure determined by the amount of labor required for its production. The farmer who is busy doing work which is unnecessary, which adds nothing to the comfort of himself or his family, and nothing to the value of his farm or any of its products, is really throwing his labor away. Work which amounts to nothing had better remain undone, for it involves a useless wear of the system, and a throwing away of vital force which can never be recovered. The man who is too lazy to work, when that work is sure of bringing its reward, is to be condemned; but the one who declines to perform labor which can by no possibility benefit himself or any one else should be accounted wise. Let it be constantly kept in mind that a waste of labor is a waste of money, and let all the buildings on the farm be so arranged that every step may be turned to some account. Upon this principle the wagon-shed should be near the barn and granary in order that when a team is wanted, and when grain is to be taken to market or to mill, no time or travel shall be wasted in getting the horse to the wagon and the wagon to the granary.

To determine the best location for the hog-house will be more difficult. There are advantages in having it near the barn, while there are also certain disadvantages connected with such a loca-



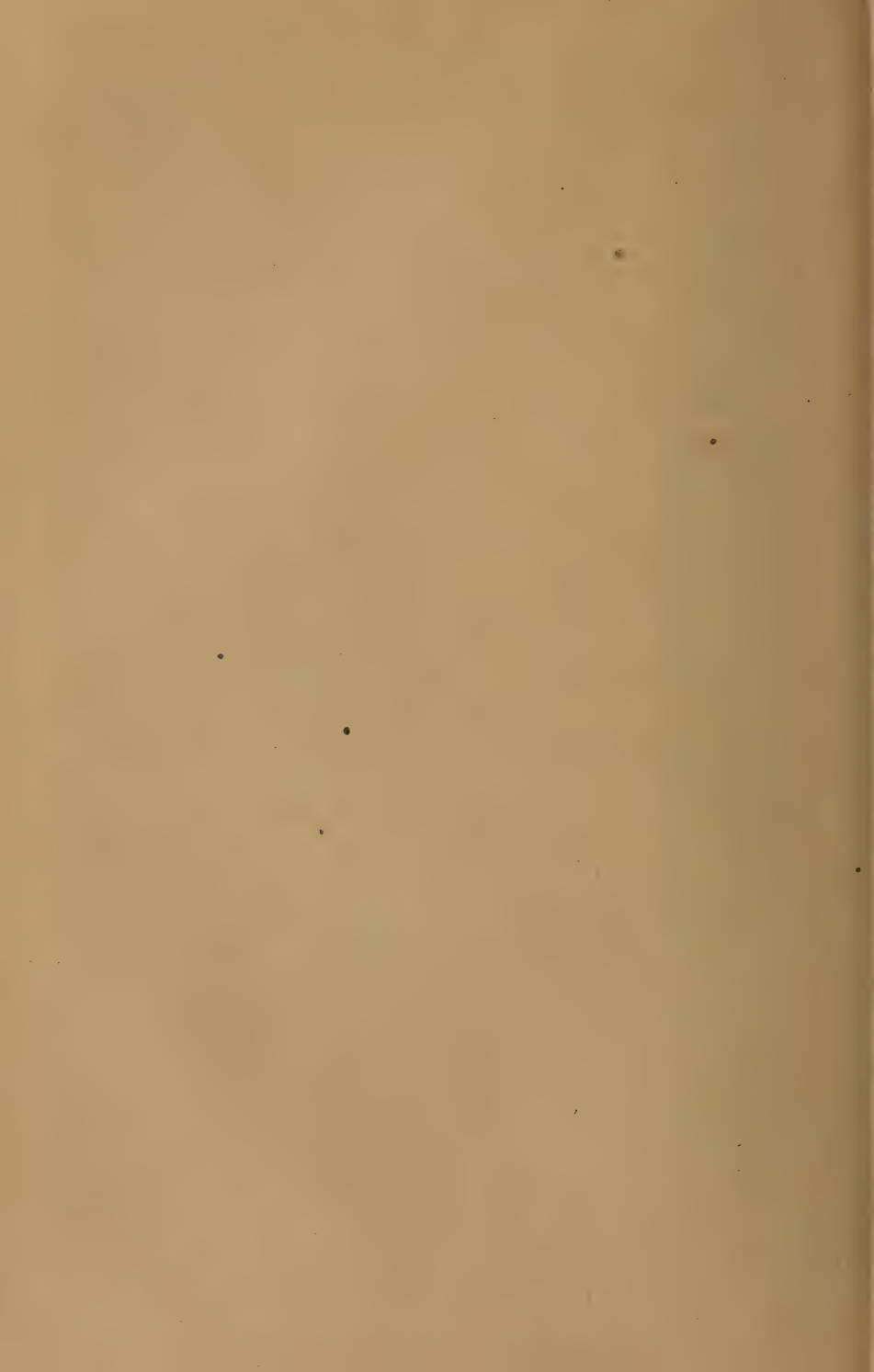
Small Fruit Grounds.]

Fig. 1.

[Farm Garden and Large Fruits,

A SUGGESTIVE GROUND PLAN FOR THE ARRANGEMENT OF FARM BUILDINGS.

1. House. 2. Barn. 3. Wagon-House. 4. Granary. 5. Hen-House. 6. Hog-House. 7. Wood-House.



tion. If the hogs are to be allowed to run in the barn-yard, they should have a house near the barn and close to the yard. But if they are to have a yard of their own it will be better to have it, in connection with their house, at a little distance from the barn. We know that some farmers, even at the North, have no separate building for their hogs, but keep them in a shed projecting from the barn on the side in which the stables of the cows are placed. This is open to very grave objections. The same is true of the method, adopted by many farmers at the South and West, of allowing hogs to roam at will in the woods and in uncultivated fields. If properly managed, the hogs can be made very profitable, and they ought to have a house and yard of their own, and to be treated like useful and valuable animals. We prefer to have the house for the hogs at a little distance from the barn, and to have the hen-house quite near the one for the hogs. The only remaining building, on a small farm, is the wood-shed, which should be joined to the house so that wood can be obtained without going out of doors. In the accompanying cut we present a ground-plan for the location of farm buildings.

SIZE OF BUILDINGS.—Unlike the tenement buildings in our large cities, there is among the country farm buildings but little uniformity of either size or appearance. It is best to have some variety in the appearance of farm buildings, and that their size should vary with the requirements of the owner. But these matters should not be left to caprice or chance, but should be governed by some law which will insure the attainment of the object desired. Before putting up a new, or remodelling an old building, the owner should carefully consider the purpose for which he wants the building, and how much room he really needs. For, building by guess, or chance, is very expensive work, and will almost certainly fail to give satisfaction. If larger buildings are erected than are really needed, the extra cost for construction and repairs will be heavy and will be

utterly wasted. But if the buildings are too small, they will prove unsatisfactory and unprofitable.

Many years ago there was a tendency among New England farmers to build their houses extremely large. Many a house for a small family was built nearly, or quite, forty feet square, and with timbers heavy enough for the strongest barn. Though this fashion has departed, there still seems to be a tendency to make the houses altogether too large, and the extra size not only costs for building and repairs, but the expense of furnishing is considerable, and the work of keeping the interior clean and bright is a heavy task for the almost invariably overworked housewife to perform. Besides, a large, overgrown house is not as pretty as a cosy cottage, and its effect upon the home-life of its inmates will be depressing rather than cheering. The passion for large rooms, in which some of our ancestors indulged, is not an economical one to gratify. We do not approve of low rooms, but there is no necessity for having the rooms in an ordinary farm-house extremely large. We have bought carpets for rooms requiring thirty yards and found this, with the other extra cost of furnishing, quite an expense. The rooms might just as well have been of a size requiring only twenty yards of carpeting, and the cost of furnishing them would thus have been reduced one-third, as well as the labor of cleaning and the cost of keeping them painted. There should be rooms enough in a house, but they should not be too large.

In some sections the New England style of putting up large buildings has not prevailed. Houses have been made very small, with but very few rooms, and barns have been smaller still, or else wholly wanting. This extreme is worse than the other. It involves constant inconvenience, and insures a continual loss of both happiness and money. There is no necessity for going very far toward either extreme. By careful thought, and a little study, concerning what is wanted, the extremes may be avoided. In building a barn, however, some allowance should

be made for a possible increase of crops, and some more room may be safely provided than is absolutely needed at the time of building. A farm ought to become more productive each year that it is cultivated. Too much allowance should not be made, as it is to be hoped, and expected, that as the products of the farm increase in quantity and value, the ability of the owner to make additions and improvements will also become greater. But room enough should always be secured. It involves a great loss to keep hay or grain out of doors. Other crops are often seriously injured by undue exposure to the elements. Unless he has determined to sell his farm, the man who finds his barn room insufficient for the proper storing of his crops should make haste to either enlarge the old or else put up a new building. If the present buildings are strong, and in good repair, it will probably be better to enlarge them than it will to either pull them down and build larger ones, or to build other small ones to be used in addition to the old ones. A tendency toward many small buildings upon a farm is not to be encouraged. To obtain a certain amount of room in one large barn costs much less than it does to obtain the same amount in three different structures. Not only is the first cost of the three small buildings much larger, but the expense for repairs is very much greater. A still stronger objection than either of these may be found in the fact that the room in small buildings cannot be used to as good advantage as it can in larger ones, and that in the use of several small ones convenience must very often be sacrificed. We would much rather add twenty feet in length to a good barn already built than to put up a new one twenty feet square. A few large buildings are not only better, but they also present a more attractive appearance than a whole cluster of small ones.

The barn is not the only building which farmers sometimes have altogether too small. On many farms the granary is a little "tucked-up" building not more than half as large as it ought to be. There are not bins enough to hold the grain, be-

cause there is not room enough in which the bins can be made. When the corn is shelled the work is invariably done at a disadvantage, because there is so little room. The wagon-shed, too, is one of the buildings which farmers seem to have a chronic desire to make a great deal too small. We once helped build a wagon-shed, which we used some ten years, and which we found, after it was all finished, was at least two feet too small each way. It was too short, and so narrow that it was almost impossible to get out, after running a wagon in, without getting the clothes dusty or muddy. There was room enough in which the wagons could stand, but not room enough for a man to go between them without a great deal of inconvenience. A multitude of other sheds have been built in like manner, and, though good enough other ways, are proving a constant cause of vexation and regret because they are so small. As far as our observation has gone, the hog-house, where there is one, is usually of better size than any other of the out-buildings. Some farmers, of course, have not given room enough to their swine, but a great many have furnished good-sized houses, and by the greater convenience of caring for them, and the better thrift of the animals, they are constantly obtaining their reward. The poultry-house, so often omitted altogether, is frequently built too small. This is not done by design, but because a great many farmers fail to realize how much room the hens require. These little animals will not bear confinement well, and the man who attempts to keep them in too close quarters will not be likely to succeed as well as he hopes or expects. Diseases of various kinds will be very likely to thin out his flock by carrying off his most valuable specimens. If there is any one thing which experience with hens has fairly demonstrated, it is that they *must* have room or they cannot be made to thrive.

HEIGHT OF BUILDINGS.—The number of square feet of ground surface which a building covers is not the whole test of its capacity or its usefulness. It makes a great difference with

both of these essentials, whether the building is high or low. That a high building will cost more than a low one of equal size in other directions is very true. But it should be remembered that *room* under cover is one of the great objects for which a building is erected, and that a great deal of extra room can be secured by merely increasing the height of the structure. Take a barn forty feet long and thirty feet wide, with posts fourteen feet in length. Aside from the gables, this barn will contain sixteen thousand and eight hundred feet. With the same size on the ground and the use of posts sixteen feet long, the barn will have a capacity of nineteen thousand and two hundred feet; thus by the addition of two feet in height adding one-seventh to its size. The first cost of this increase in capacity will be very small, and the extra expense for repairs will be next to nothing. It will cost no more to keep the roof in repair, and but little more to keep its sides covered. In this way a large amount of room is secured at a very trifling cost. A wagon-shed with posts eight feet long will do very well for this one purpose, but it will be good for nothing else. If the posts are thirteen feet long, quite a room can be had over the wagons. This will be sure to be convenient for the storage of rowen, beans, corn-fodder, or other farm crops. In a building thirty feet by twenty, there would be room on the ground for a wagon-shed, while in the loft from four to six tons of hay could be easily stored. A shed for open wagons will not need to be more than seven feet in height from the floor, but the part designed for top carriages should not be less than eight feet between the floors.

The granary should also be built higher than many such buildings have been made. Here there is not as large a gain of room as in the other buildings which have been named, because bins for wheat, oats, and similar grains, should not be made very high. This, partly on account of the inconvenience of filling and emptying them, and in the case of wheat and shelled

corn, partly because of the strong pressure which a very large quantity would exert upon the sides of the bin. The crib for containing ears of corn is the only one which can well be carried higher than the usual level. By the use of a good step-ladder this can be conveniently filled, and though the room in a high granary does not seem to be as well utilized as it is in a low one, it is still a question whether what is wanted in such a building cannot be secured at a less cost by increasing the height than it can by enlarging the ground surface. The upper part of the room, around the sides occupied by the wheat and oat bins, might be used for the storage of traced seed-corn, and shelves might be arranged which would furnish a place for keeping many little articles which are needed on a farm in connection with the growing, harvesting, and cleaning of grain.

If these buildings are to be used for no other purposes than are indicated by their names, the hog-house and hen-house need not be built very high ; but in all cases there should be abundant room for a tall man to stand upright with his hat on, in the lowest part of the building. We have seen many buildings for these purposes, in which even a short man could not stand erect. With one of them we have had a practical experience, the results of which have been anything but satisfactory.

ADAPTATION.—A very important point to be considered in either building new, or remodelling structures which have already been erected, is adaptation to the purposes for which they are designed. A barn should be so constructed as to answer all the purposes for which the owner wants a barn. A hog-house should be built for this one special purpose. The combination buildings, which are made to answer for hogs or horses, hens or sheep, according as the owner is supplied with the various kinds of stock, are not desirable. They are like some patent pocket-knives, designed to answer many purposes, but answering none of them well. These buildings usually cost as much to put up and keep in repair as good ones would, while in practical use

they prove very unsatisfactory. Upon this subject some curious theories have been suggested. A few years ago a man recommended a style of barn, which he proposed to build, and which he was confident would give satisfaction. This barn was to be built of stone, was to be one hundred feet square, and have a flat roof. It was to be merely a covered shell, into which the owner could drive through large doors, and then go where he pleased. Hay was to be thrown off wherever he took a fancy, some years in one place and others in another. He thought he could "clap up a horse-stall" when and where he chose, and change the location of the stalls for cattle when and as he pleased. A long description of this plan appeared in one of the leading papers. Merely in the point of a theory it was a curious production, but it did not possess the slightest practical value. The first cost of such a building would exceed the value of a good farm, and after it was built it would have no sort of adaptation to the wants of a farmer, or any one else. In this latter point, however, it differed but little from some barns which have been erected since this theorist's day. For many farmers have applied to architects, or consulted books for plans, and selected something which looked nicely, or was highly recommended, who have found, when it was too late to remedy the mistake, that their fine-looking buildings were not adapted to their circumstances and wants.

Not that architects and plans are useless. On the contrary they are great helps. But there should also be a clear idea in the mind of the owner as to just what he wants, and just what his business requires. Of these points no one can judge as well as himself. He needs the architect or the plan for an aid, not for a pattern to be strictly followed. The fact that a certain style of barn has just suited one farmer, gives no reason to suppose that it will be perfectly satisfactory to another who lives in a different town, and whose style of farming may be altogether different. In order to secure a building which will

be satisfactory, the size and style should be adapted to the special needs of the owner. The kind and amount of business which is to be carried on should be kept constantly in view, and instead of doing just as his neighbors have done, the owner should put up a structure suited to his individual needs. A granary which is suitable for a large farm at the West would be wholly out of proportion for a small farm in New England. It would not be adapted to the Eastern farm, either in size, or shape, or interior arrangement. A plan which would do very well for a farmer in one of these sections would be of no benefit to one living elsewhere. The New England man needs buildings adapted to the style of farming adopted in that section, while the farmers West and South should arrange their buildings so that they will be adapted as perfectly as possible to the methods in use in their respective sections of the country.

COST OF BUILDINGS.—There are few points upon which the judgment of the average farmer is more at fault than in estimating the cost of erecting new buildings, or repairing and remodeling those which are old. This fact does not indicate any special want of penetration on the part of farmers, for the same charge can be justly brought against men engaged in many other occupations. Even the figures of the architect himself are quite often at fault, and his estimate proves but little nearer right than the farmer's guess. Almost every one knows that the cost of either building new or repairing the old usually greatly exceeds the estimates of the owner and the architect. It has been said to be a good rule to carefully estimate the cost of material and labor, together with all the items of expense which can be thought of, and then to the sum total of these add from one-third to one-half of the whole. And though the figures of the architect often seem a great deal too high, it seldom happens that they cover the cost. Various causes operate to bring about this result. It often happens that changes are made in the plan. These, though small in themselves, in the aggregate consid-

erably increase the expense. Lumber is not always bought to the best advantage. Then, too, many workmen are not as careful as they should be, and by their negligence considerable waste of material is effected. The cost of building or remodeling depends far more upon the honor and skill of the workmen than many employers imagine. Then, too, the degree of ornamentation of a building has a great influence upon the cost. Several hundred dollars can be used upon a house in this manner, and not make a great deal of display either. Upon some houses, which have been erected by farmers for their own use, the cost of the ornamental features bears a large proportion to the expense for what was really necessary for the construction of plain but comfortable structures. As an almost invariable rule ornamental work, whether outside or inside, if it is really nice, will be quite expensive. Compared with the plain but tasteful work, which seems specially appropriate to a farmer's home, it is very costly. An excessive amount of ornament is not only terribly expensive, but is also wholly out of place upon a farm-house. Very few farmers have the means which they can safely use for the purpose of making their houses as elegant as those of their city neighbors. Good, substantial work is what the farmer needs. This will cost something, for all good work is somewhat expensive. There can be no excellence in any department of industry without some cost. But if the plan is carefully made, good materials secured, and good men are employed to do the work, suitable farm buildings can be erected, and the cost kept within the means of the prosperous farmer. In some sections it costs as much again to erect buildings as it does in others, because lumber, nails, bricks, and other materials have to be transported long distances, and paid for at the high rates which scarce commodities always command. Therefore no specific sum can safely be stated as the cost of a certain style of building. An estimate may be too high for one section, and too low for another. But

an estimate should be made by the proposed builder, and be carefully examined by the one who is to pay the bills. In case it seems unreasonably high, another contractor should be consulted, and the figures of the two compared. In his excellent work on "COUNTRY HOMES," Mr. Todd assures his readers that professional builders aim to keep people very much in the dark concerning the real cost of all kinds of edifices, and that it is customary with the profession to place the estimate for a house at from one to four thousand dollars higher than it should be. And there is a great deal of force in his suggestion that an inexperienced man, who is about having a building erected, should carefully examine every item for which the contractor estimates, and make sure that the articles are all needed, and in the quantities indicated, or else require him to reduce the price demanded for the work.

The quality of the material which is used will also have much to do in determining the cost of buildings. If everything about the building is to be of the finest quality, the cost must be greatly in excess of what it would be if lower grades of material were used. While it is the very poorest style of economy to use poor lumber for either outside or inside work on a house, or for many parts of other buildings, it is still true that a great deal of lumber which is not strictly first, or even second, class can be worked in where it will answer every practical purpose as well as the very best. All parts exposed to the weather, and the inside of rooms in a house, should be covered with well-seasoned material of good quality. Where low-priced lumber will last just as long, and answer every practical purpose just as well, it should certainly be used. Where it will not prove durable and useful it should just as certainly be rejected. When farmers get out their own lumber, they are very apt to be in too much hurry to allow it to get fairly seasoned. But in using it green they make a great mistake, and one which they will always regret. When the materials are to be purchased, it will pay to

employ an honest and careful joiner to make the selection and do, or assist in, the buying. Some farmers attempt to save themselves both time and trouble by employing some one to take the whole charge of the plan and construction. Others try to secure the performance of the work in an honest manner by employing men by the day, and paying them for all the time spent upon the building. If all the parties are strictly honest, either way will give satisfaction to all concerned. But if either party is disposed to overreach, there will be plenty of opportunities in either method. The contractor can slight his work enough to make several hundred dollars difference for himself in the cost of putting up a house. He can make slight changes in the plan, use poor material, or in other ways avoid expense and put money into his own pocket. The man who is hired by the day can work slowly when his employer is away, or can do a great deal of work which is wholly unnecessary, and charge full rates for its performance. On the other hand, the man who hires the work done can hinder and worry the workmen so that they will not be able to do as well as they hope and desire. Such conduct, upon either side, is worthy of unsparing condemnation. The man who is about to build should take pains to employ none but honest workmen who will not need watching, and should treat them precisely as he would want to be treated in an exchange of positions.

Before commencing the erection of new buildings, or the remodeling of old ones, the farmer should deliberately and carefully count the cost. He should make his estimates not only of the dollars and cents involved, but should consider the subject on a broader basis, including the probable influence which the proposed improvement will exert upon his future prosperity as a farmer. He should carefully consider whether he can safely withdraw from his active business the amount of capital which his building project will require. Otherwise he will be very likely to make a ruinous mistake. There is danger

of getting too much money invested in buildings. Upon this rock many a farmer has been wrecked. When men go beyond their means in building, they place themselves at the mercy of the first financial storm, and become liable to lose not only their opportunities for obtaining wealth in the future, but also a large part of their past accumulations. It is a great deal better, as well as safer, for a farmer to live in an old but comfortable house, and be free from debt, than it is to have a fine, new house with a heavy mortgage on the farm. A short road to financial ruin has often been entered when the farmer put up a much more expensive house or barn than he could afford. It should never be forgotten that money which is invested in a house or barn, for ordinary farm purposes, is wholly unproductive. If the amount invested does not exceed the actual necessities of the case the money is not wasted. If it does not bear too high a proportion to the productive capacity of the farm it is not unwisely used. For buildings are necessary as a protection for life and property. They confer happiness, preserve health, and save the farm crops from waste, and often from total loss. But their various benefits may be secured without the use of an excessively large amount of money. The buildings should be neat and nice, but they should also be plain and substantial. A really nice house is not a gaudy one, and need not be very costly. The surroundings can be made pleasant, and a plain house will then give a feeling of contentment which a highly ornamented one will fail to supply. An excess of ornament is wholly out of place on a farm-house. The grounds may be made ornamental and be in good taste, but a farm-house modeled after a hotel, or a summer boarding-house, is not at all appropriate. And the income from but very few farms will justify the erection of expensive buildings. Farmers often over-estimate their financial ability, and find, when it is too late, that they have drawn too heavily upon their capital, and crippled their resources by putting up too costly houses. If a man has money in the bank, or drawing

interest elsewhere, and uses this in building a house or barn, he thereby not only loses all the interest from the money thus invested but he also puts it where, even in case of an emergency, he cannot use it. The only way in which he can realize anything from it is to sell his farm, and experience has proved that farms with nearly new buildings will command but little higher prices than those on which the buildings are old. As far as getting any cash return from it while he lives on the farm, the money is just as securely locked up as it would be if it were in a vault which could only be opened by one key, and that key were lost where it never could be found. If the farm is sold in order to obtain the money, it is highly probable that only a very small proportion of it will ever be received. If a farmer is willing to take the principal and interest of his money in comfort he can put it into buildings, but it will not be wise for him to invest it in this way with a design of obtaining any cash return.

But the majority of farmers who have a strong desire to put up new buildings have little or no ready money, and will be obliged to borrow of others if they carry out their cherished plans. Such men ought to "make haste slowly." With them the case is not nearly as favorable as it is with those who have money. It may be easy enough for them to borrow what money they need, but it will be difficult for them to pay it. In putting borrowed money into buildings they assume a heavy burden. They know that many men have borrowed money with which to buy land, and that they have not only kept up the interest but have also paid the principal. From this they infer that they can borrow money with which to put up buildings and soon get out of debt. This is a great mistake. There is a vast difference between buying land for cultivation and investing money in farm buildings. Land is productive property and can be made to furnish the means of *paying for itself*. Year by year it may be made to not only return money enough to pay the interest but

considerable more, and, in time, a skilful manager may be able to pay for it wholly from the receipts from the sale of articles grown thereon. But money which is invested in a house or barn not only returns no interest and makes no payment on the principal, but is a constant source of expense. Interest must be paid, and the money with which to pay it must come from the farm. It is neither wise nor safe to withdraw too much capital from the land where it is productive and invest it in buildings which are a constant source of expense. The wise farmer will have plain buildings, and invest the remainder of his capital, if any, in developing the productive powers of the soil.

REPAIRS.—Farm buildings are subject to the natural law that “all things hasten to decay.” Consequently, frequent repairs become a matter of necessity for securing their preservation. There are various reasons why these repairs should be made promptly and well. In order that the farm may present a fine appearance the buildings should be constantly kept in repair. The expense of repairs will also be greatly reduced if they are made promptly and thoroughly. Besides, the buildings will be kept in a much better state of preservation if repairs are made as soon as their want becomes apparent than will be possible if they are long delayed. Every one knows that the longer a ragged coat is worn without being mended the greater the amount of work, and the larger the quantity of material, which will be required to put it in good order. It is also known that if repairs are delayed too long the coat will become so badly damaged that it will not be worth mending. The very same principles apply with almost equal force to the repairing of farm buildings. If a house needs painting, the sooner the work is commenced the less will be the cost. If too long neglected, the surface becomes so rough and weather-beaten that it cannot be painted well, and it will be very difficult to paint it at all. If a roof is shingled as soon as the need of shingling becomes apparent, the building will not be injured; but if the old roof is left year after

year, continually growing worse, there is danger that the whole frame will be weakened and decayed by exposure to the weather, and that all parts of the building will become involved in one common ruin. Nothing is to be gained by neglecting necessary repairs, but a great deal will inevitably be lost. Not only should repairs be made promptly, but they should be attended to in a thorough manner. If a roof needs shingling, let it be shingled well. If a house needs painting, let it be well painted. While doing the work, it will cost but little more to do it well than it will to slight it, but good work will last as long again as that which is poor and give much better satisfaction.

PAINTING FARM BUILDINGS.—Probably the great majority of farmers paint their houses and neglect to paint their barns. Many in all, but still a very small proportion of the whole number, paint both house and barn, a very few paint all of their buildings, while a great many leave all their buildings unpainted. The design of painting is two-fold. It tends to preserve the timber to which the paint is applied, and it adds to the beauty of the buildings which it covers. In some cases the motive for painting is the design and desire to make the buildings present a finer appearance, in others the paint is applied merely as a preservative, while many farmers have in mind both these advantages which painting is supposed to secure. That a building which is well painted looks much better than it otherwise would cannot be denied. It is also true that paint will tend to preserve the woodwork to which it is applied. If the farmer is able to do it he should keep his house painted merely for the sake of appearances. It will give a great deal of satisfaction to have a clean and nicely painted house. The wife and children will rejoice in the freshness and beauty which paint will insure. Painted buildings indicate a certain degree of refinement and prosperity, and the man who can easily afford it should not fail to keep his house painted. But the farmer of small means, who is often brought face to face with the question, "Will it pay,"

may hesitate before deciding to paint his buildings. In his case the matter of appearances must be put over to a brighter day, and his decision must be made on the sole ground of economy. If painting the house will make its covering last enough longer to pay the cash outlay, and the interest thereon, it should by all means be performed. If it will not pay, if the cost of painting will exceed the cost of re-covering the house, when such a course becomes necessary, it should not be attempted. Whether it will pay or not depends upon the cost of lumber and labor as compared with that of paint. In some sections, painting would prove quite profitable, while in others it would not pay. It will now be more generally a source of profit than it would a few years ago. For, within a comparatively short time, what are called "mixed paints" have been put upon the market and come into very general use. Some of these brands of paint are both cheap and good. Though many professional painters opposed their introduction, they have already proved quite popular. By using these paints, the farmer who has a little skill with tools can readily do his own painting. Thus the cash outlay for painting a building is greatly reduced. Before these paints were invented, the farmer usually hired a painter to do all the work in the painting line which he had performed. It was a sort of necessity for him to do this. He could not mix paints well himself, and painters did not wish to mix them for him. They preferred to furnish and mix the materials, and then put them on. Now the farmer can measure the surface of the building which he wishes to paint, find just about how much will be needed to cover it, buy just that quantity of paint, of any color or shade desired, which is all ready to put on, and can apply it himself. A very few dollars' worth of paint will give two coats, of suitable thickness, for an ordinary house, and where lumber is at all expensive, it will be a matter of economy to apply the paint for the sake of preserving the covering of the house.

We do not say that the mixed paints are better than the old-

fashioned white lead. Some of them we know are not as good. Other brands have worn well and given perfect satisfaction. Much of the white lead is badly adulterated, and paint made by its use is very poor. There seems to be as much certainty of securing a good article by getting a well-known brand of mixed paint as there is in buying lead and oil, and there is the great advantage of having it in a good condition to use whenever it is wanted. One fact which should not be lost sight of in this connection is, that while the farmer can paint his house he cannot clap-board it, and this must be taken into the account, in estimating the relative expense of painting or re-covering. If he paints, the cash outlay is merely for the material and a brush with which to apply it; but if he desires to put on a new covering when the old is decayed, he must not only pay for the lumber, but a workman must be employed to put it on. As the cost of boarding a barn is much less than that of a house, upon which clap-boards are generally used, painting merely for the sake of preservation will not be as much of an object. But in many places, where lumber is expensive, it will be profitable. The same rule applies to the other buildings.

Ability to paint well must be obtained by practical effort far more than by reading. A few general directions can be given, but a certain amount of practice will be needed to make any one a rapid and skilful painter. Still a few suggestions may prove useful. The surface to be painted should be clean and smooth. If it has become soiled, it should be washed and allowed to dry; while if it is rough, it should be smoothed with sand-paper, or some more effective material. Where it is very rough, the surface may be rubbed with pumice-stone. For ordinary outside work, there will probably be but little need of this labor, but it is often required for inside painting, which is designed to have a nice finish. The outside of a house which has been long neglected frequently fails to hold the paint well, and it rapidly scales off. This is caused by a separation of the

oil and lead, of which the paint is composed. The oil penetrates the wood and the lead falls off. This can be prevented by applying one or two coats of cheap oil before the paint is put on. It is also claimed that some of the mixed paints are so made that they are not open to this objection. The work should be done in good weather, either in the spring or fall, when it is neither very hot nor very cold. A good brush is also one of the necessary articles, and a good, strong ladder, a clean tin-pail, and a hook by which it can be suspended from one of the rungs, should be secured. Too much paint should not be put on at a time, as it is no advantage to the building and makes the work much harder. It is not well to attempt to reach too far from the ladder, and special pains should be taken to brush over the laps, where the "works meet," smoothly, so that the building will present a uniform appearance. Neglect of this precaution is the cause of a large part of the poor painting done by farmers and mechanics, who have had but little experience in using the brush.

The color of farm buildings is a subject worthy of at least passing notice. Several years ago, that accomplished scholar and traveller, MR. BAYARD TAYLOR, called attention to the fact that a very large proportion of the houses in the country which were painted at all were white, and he endeavored, in various newspaper articles, to influence owners to use colors which would give a greater variety of appearance, and do away with the unpleasant glare of white buildings in sunny days. Whether as the result of his efforts we cannot say, but it is a fact that since that time the softer tints have come into very frequent use for outside work upon houses. As far as protection to the buildings is concerned, this change has involved no loss, while the appearance of the villages and hamlets to which this innovation has spread has been greatly improved. It is not in the best taste to have all of the houses in a village painted any one color, but, if they were all to be alike, white would not be the best complexion which could be selected.

In the winter, white does not furnish a sufficient contrast with the covering of the ground in the Northern States, while in the bright sunlight of a midsummer day the glare of an unsubdued white is both painful to the eyes and displeasing to the taste. In the choice of colors and shades there is an opportunity for the display of considerable skill and a cultivated taste. The body of the house can be painted one color, and the cornices, corner-boards, and casings another shade, thus producing a very fine effect and involving little or no additional expense. The house may be painted one color, the barn another, while still different colors or shades are used on the other buildings. If care is taken to select colors which harmonize, the effect of these many colors and shades will be highly satisfactory. As variety of color will add much to the beauty of the work without materially increasing either the labor or expense of painting, it seems very desirable that farmers who paint their buildings should make a careful selection, and have the work done in a manner which will give a beautiful appearance as well as furnish a protection against the destructive influences of the weather.

Here some practical man may say, all this is very good as far as appearances go ; but how can it be made profitable ? If painting is to be done in order to make a building last longer, one kind of paint is just as good as two or three sorts, while, if it is not an object to paint merely to preserve the timber, all the money and labor are thrown away. To this it may be replied that we have not advocated extra expense merely for appearance, except when the parties were abundantly able to meet it ; that the cost of painting with two or three different colors is but very little in excess of that of using plain paint, and also that, where men are able to do it, money is not thrown away which is used to improve and beautify the appearance of their homes. A farmer who desires to keep his boys with him on the old homestead will be a great deal more likely to succeed if he keeps the buildings nicely painted and his surroundings pleasant, than he will

if he neglects these things and allows the house to become brown and weather-beaten. Boys like pleasant surroundings, and they have an idea that somewhere in the world such surroundings can be obtained. If they do not find things pleasing at home, they are very likely to go elsewhere. That they often make a great mistake in doing this is true, but this does not at all alter the fact that boys do, and will, leave surroundings which are unnecessarily unpleasant. If it is an object to keep them on the farm, it may pay to do some things which they desire. The expense involved in "fixing up" things so that a boy of healthful tastes will be willing to stay on the farm, will be money well invested. The father will never have cause to regret it, and it may be the making of the son. The sooner farmers who have the means for doing it become aware of the fact that a little money laid out in improving the appearance of the home and farm is not only not wasted, but is well invested, the better it will be for them and for their descendants.

THE HOUSE.—The general arrangement of a farm-house should be determined by the special wants of the owner and his family. Much will depend upon the amount of money which is to be invested. The special line of farming which is to be pursued must be considered. The section of country, distance from a village, and length of time which can be given to its construction, will, together with many other things, exert a modifying influence. Fig. 2 represents a very pretty, and not expensive, house for a farmer. Fig. 3 shows the arrangement of rooms on the ground-floor—an arrangement which can be readily varied to suit the special wants of the family. Fig. 4 shows a plain and cheap, but also neat and convenient, cottage.

We do not present elaborate plans, for we do not consider them of special value to the farmer. He should not be persuaded to build after a certain model, because an architect has pronounced it good. The owner should be guided more by his own wants than by the general plans which other men have

designed. Many a new house is unsatisfactory because the owner did not insist upon modifying the plan of the architect so that it would suit his own tastes and needs. We once noticed some peculiarity in the arrangement of a barn, and remarked to the owner that such a plan was not common in our section. He replied that he had the barn arranged for his own special convenience. The carpenter who built it did not like his suggestions, and wanted to follow the ordinary models, but

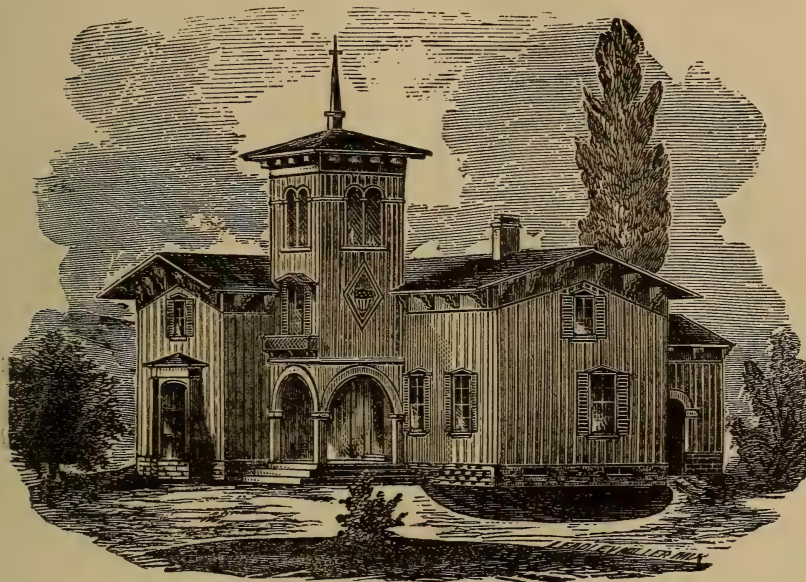


FIG. 2.—FARM-HOUSE.

the owner told him that for many years he had worked for other men, and worked as they wanted he should, and now that he was able to gratify his own taste somewhat, he was determined to have his barn made just as he wanted it. He carried his point, and the barn suited him a great deal better than it would if he had allowed the carpenter to go on without regard to his special tastes and wants. In putting up houses, and other buildings, this example should be followed. Of course, in certain departments of the work, the ideas of the farmer should

not be opposed to those of the skilled mechanic. In regard to the fitness of certain kinds of timber for certain uses, the strength of materials, and many things of like nature, the education and experience of the practical builder should be regarded. But when such questions as the number of the rooms, the location of the doors, and the size of the windows, are debated, the farmer should insist upon his right to decide. If his house does not look just like those belonging to his neighbors, it may suit him just as well as though it were an



FIG. 3.—PLAN OF GROUND-FLOOR.

exact copy. Not only should he think about the plan himself, but the tastes of his wife and children should be consulted, and should be gratified, if possible. One of the best ways to secure a house which will be satisfactory is not only to obtain a plan, and make any changes which seem to be required by the special needs of the one who is to build, but also to visit the houses of some of the neighbors and friends who have recently built. By seeing a house that is already built, a much better idea of its convenience and adaptation can be secured than will be

possible by merely seeing a plan of the structure on paper. Besides, practical use is the great test of houses, and by inquiry it can be ascertained whether certain styles have proved desirable. Thus a great expense, and much trouble and disappointment may be saved. It is well for people to learn both from the successes and the failures of others. For, though personal experience is a very good teacher in some respects, the expense of obtaining knowledge by its aid is greater than the majority of people can really afford to incur. When the past experience of others can be made to answer just as well as personal trial, there can be no reasonable excuse for insisting upon testing the matter again. The man who wants to build a house will do well to examine several houses which appear to be the best adapted to the purposes which he wishes to serve. If a barn is to be erected, the man who is to build should not only obtain a plan, but should examine barns which have been put up by his acquaintances. The same rule applies to the construction of other buildings. Excellencies and defects both show much more distinctly in a building than they do in a plan, and, for this reason, buildings should be examined as well as plans. Neither should be blindly followed, but both should be used as aids.

Some of the requirements of a good farm-house should be briefly considered. They can nearly all be summed up in the two words, NEATNESS and COMFORT. The house should look nicely, because it is to be the home of the farmer and his family. A neat and pretty house will have a certain degree of influence upon its inmates. It is better than a shabby one, though a shabby one if it is paid for is a great deal better than no home, and is more desirable than a nice house which has brought financial ruin to its owner. But comfort is usually considered the main thing to be secured by those who are not specially anxious to keep up appearances. Yet, strange as it may seem, though the great idea of obtaining a house is to enable a man

to secure a comfortable home for himself and his family, when he comes to build, the average man neglects to secure the comfort which he might just as well, and without extra cost, obtain. If any one doubts this let him examine the rooms in an average house, and he will find ample confirmation of the truth of the

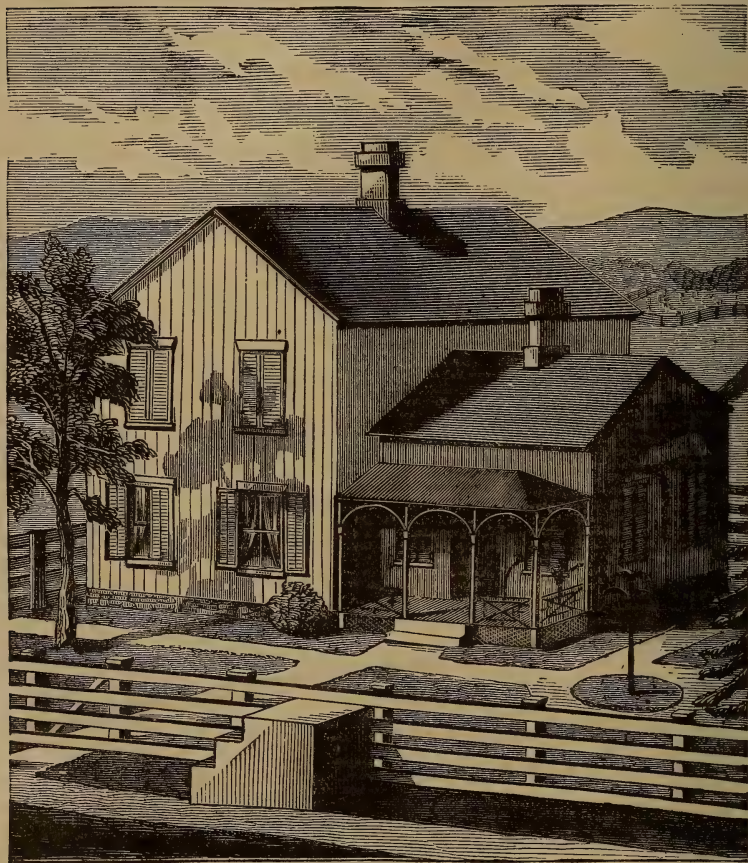


FIG. 4.—COTTAGE.

statement. If comfort had been one of the principal things in the mind of the builder, the rooms would have been very differently arranged. Instead of having the kitchen and pantry some ten or fifteen feet apart, they would have been adjacent rooms, and both the wood-house and the cellar-stairs would have been

close to the kitchen. We know of a house in which the pantry is some six feet and the cellar-door twelve or fifteen feet from the side of the kitchen nearest to them. The unnecessary distance travelled and labor performed by the housewife under such an arrangement is immense. As one of our common-sense architects, EMORY A. ELLSWORTH, ESQ., has well said: "Need we wonder, when we consider the many useless, weary steps that must be taken, and the stock of vital strength that is continually wasted in the performance of the household duties, that so many ambitious farmers' wives are broken down in health and spirits at thirty-five, and must then remain for the rest of life the suffering victims of thoughtless, careless, interior household arrangement." We wish these words could be indelibly stamped upon the mind of every man who has charge of the arrangement of rooms in farm-houses, and that every man who either builds a new, or remodels an old, house would strive to make the interior as convenient as possible for the wife and daughters who are obliged to do the work. Life is too short to waste in useless and aimless pursuits, and the burdens which rest upon the farmer's wife are too heavy to justify any unnecessary increase.

In the Northern and Western States warmth is one of the prominent requirements of a comfortable house. In the summer, and for a few weeks previous to its coming, and succeeding its departure, this is not of great importance, but for about one-half of the year it is absolutely indispensable to the highest degree of comfort, as well as necessary in order to promote the health of the inmates. A cold house is not a comfortable house in which to live, and it is almost impossible to make it pleasant during the cold season. Upon such houses radical repairs are badly needed. For the cold from which the inmates of these houses suffer cannot be kept out, or sufficiently subdued, by fires, and it proves not merely a great discomfort but also a positive injury. The "hard winters" of New England

would lose much of their severity to a great multitude of farmers' wives and children if they could have really warm houses in which to live. No one who has never lived in one of the old and loosely boarded houses which are occasionally seen in country places, has any idea of the degree of suffering which is inflicted upon the inmates by the cold. That there is such a thing as having a house too close and warm we admit, but we think that very few such houses can be found in the possession of farmers.

So far as our observation extends, farm-houses go very far toward the other extreme. Cold air blows upon the inmates through cracks and crevices, causing many colds and laying the foundation, in a great many cases, of serious diseases. There is not only discomfort involved, but, if special care is not taken, it is absolutely dangerous for a person with weak lungs, or with a strong tendency toward pulmonary complaints, to live in such a house. When a house is built it should be made so well that even when it becomes old the winds will not penetrate its walls. If built of brick, or stone, there will be no difficulty in securing this protection from the wind. If wood is used as the principal material for construction, a good quality should be secured for the covering, and it should be put on in a workmanlike manner. The space between the outer and inner wall should be filled with bricks, except where posts, studs, and braces are placed. For an ordinary-sized farm-house quite a quantity of bricks will be required, but second-hand ones can be used, or a low grade of new ones, and thus the cost be kept from being a very large item in the bill for materials. No special skill is required to lay them. They answer various good purposes. By keeping out the wind they keep the rooms a great deal warmer than they otherwise would be, and, by filling up the space, they effectually prevent rats and mice from taking up their abode in this most difficult of all places from which to dislodge them. For the last named purpose alone they are worth five times their cost. If

any one thinks this valuation too high, let him try to sleep for one night in an old-fashioned house which is infested with rats, and before morning he will probably be convinced that instead of being too high the figures are altogether too low. All the work about the house should be done well. It will take a little longer to fit every board exactly to its place, but the house will give much better satisfaction if this is done than it can if the work is slighted. It is not a difficult matter to build a house so that the wind will not penetrate it and it will not be cold; but, when a house has been badly built, it is difficult to repair it in such a manner as to make it comfortable.

The inside walls of a house should be well plastered, and the ceiling should be finished as nicely as possible. Though it is quite common to cover the walls with paper, there should be no slighting of the work in plastering them. If well covered with good mortar they can be papered more easily, and the paper will look better than will be possible on a poorly-finished surface. The mop-boards should be well fitted, and all the lumber used in the inside of the best rooms should not only be well seasoned but should be kiln-dried before being used. This precaution would have prevented many unsightly cracks in some otherwise nice houses.

WINDOWS are always considered as necessities in a house; but they are not always arranged in the best possible manner, and the number and size are not always chosen in accordance with the requirement of either beauty or comfort. We think there is a tendency to use too few windows. The sunlight is not allowed as free access to our houses as the health of the inmates requires. The power of sunlight to promote health and make people cheerful and happy is not fully recognized by the farming community. Yet we all know that a succession of cloudy days will depress the spirits of cheerful people and increase the suffering of invalids. Too many families have shut out the light from their homes altogether too much. The parlor is not opened to the

sun for fear that the carpet will be faded by his powerful rays, and even the kitchen and sitting-room are guarded against the intrusion of too much light. Living in darkened rooms, and being often worried and overworked, it is not a matter for surprise that many farmers' wives lose both beauty and health in comparatively early life. In sections of the country where women are more in the open air and receive the benefit of the sunshine, they are much more healthy than they are where custom or necessity requires them to keep in doors nearly all of the time. The dullest observer knows that plants need the sunlight, that those which are kept in the shade are imperfectly developed and lack both vigor and freshness, and that fruits which grow in the shade never present the rich and rosy appearance of those which are ripened in the sun. And it seems as if the observer who could see all this could also reason that, if the sun is such a life-giver and invigorator to plants, his influence upon the human family must also be powerful for good. Prominent physicians often recommend sun-baths for the cure of certain forms of disease. As prevention is always easier than cure, it is fair to infer that sunlight would do much toward keeping people well. It is well known that people living in dark, damp cellars are terribly afflicted by disease, and we are justified in believing that the want of sunlight is one of the producing causes of many of their maladies. We believe in having a house into which the sun can shine, and in having the kitchen and sitting-room in the sunniest part of the house.

Windows should be plenty in number, and of a size to correspond with the dimensions of the house in which they are placed. Very small windows do not look well in a large house, while large windows look almost as badly in a small one. The windows should not be placed too high in the rooms, as is the case in some of the old-style houses, neither is it very convenient to have them come down to the floor as some modern builders propose. Medium-sized glass gives a farm-house win-

dow a better appearance than either very large or very small panes. It is much less work to keep such windows clean than it is those which are composed of small panes, while they are less expensive than very large ones. Not only is the expense of windows increased by using extremely large panes of glass, but in case that one is broken, a large size cannot always be obtained at country stores, will cost considerably more than the medium size, and the difficulty of setting will be increased.

In buying glass always be sure and obtain a good quality. A window in which there is not a pane of clear glass is a miserable thing to look at or to try to look through. It will cost a very little less than a window with a good quality of glass, but it will always be a source of vexation and discomfort. The sashes should be made of heart timber, and should be well put together, and thoroughly painted upon both sides. Some kind of fastening should also be used upon all the windows in a house. Many people use fastenings upon the windows of their lower rooms, in the vague hope that they may prevent the entrance of intruders, but in the upper stories get along with sticks, wooden buttons, or some other inconvenient arrangement. There are a great variety of patent springs and fasteners in the market. Of these many are very good indeed, while some are, as any one of common sense ought to know without trying, miserably poor. A fastening should be secured which will hold the sash either down or up, or at any desired point between these extremes, and which will not mar the casings. The windows should also be made to lower at the top as well as to allow the lower sash to be raised. This in order to admit of easy ventilation, and also to make the rooms cooler in summer.

In arranging the DOORS considerable skill will be required to place them so that they will give convenient access to all parts of the house, and still not interfere with each other. Although many doors will increase the first cost of a house, and always

render painting the rooms more expensive than it otherwise would be, it is not well to attempt to reduce the number below the point which comfort and convenience require. Too few doors make a house inconvenient, and will add greatly to the labor required to keep it in order, and care for the comfort of the family. The doors should not only be enough in number and well arranged, but care should also be taken to have them of the proper size. In many farm-houses the doors are much too narrow, and a great deal of inconvenience is caused thereby. There is no necessity for using very small doors, and no one should allow them to be used in an ordinary house. The doors will require something in the line of fastenings. There are various styles in the market. Of these we think the combined catch and lock, with a knob on each side of the door, is much the best. That the first cost of fitting all the doors in a house with these fastenings will considerably exceed that of using the old-fashioned latch and catch we admit, and some readers may be inclined to regard the change as an extravagance. But, as we have already pointed out, convenience, which is another word for economy of time and labor, is often worth far more than its cost. If a convenient arrangement saves work, it thereby saves what is equivalent to money. If it saves health and strength, it saves what is worth more than money. Human life and strength are both limited, and the strongest person has neither time nor strength to waste. The door-fastenings we have recommended will save much time. They also furnish, what the door of each of the principal rooms below and all of the sleeping-rooms should have, the means for securely fastening it from either side. But the principal reason why we favor these fastenings may be found in the fact that they are not liable to catch and tear the clothes. In a large family the saving effected in this one direction would be sufficient to replace the old-fashioned latches with the knobs and locks which we have recommended. Our own clothes have been torn,

and all the members of our family as well as occasional visitors have had clothes damaged by being caught on the old style of fastening. Experience has taught us that good door-fastenings are really cheaper than clothes.

THE FLOORS of a house should be made of good material and carefully put down. The supports should be very strong, and it is a good plan to have the boards an inch and a half thick. Few persons whose attention has not been specially called to the subject are aware how severe a strain sometimes comes upon the floor of a house. When there is a social gathering, quite a crowd is often collected in a single apartment. In a room fourteen feet square it is not difficult to find standing places for from eighty to one hundred grown persons, and a man who knew nothing in particular about such matters would not think any trouble would be caused by allowing them to enter. But eighty persons of average size will weigh not less than *five tons*. This is a great strain, and a weak floor will be very likely to give away under it. It is true that such a weight is not often brought upon a floor in a farm-house. But it is liable to be heavily loaded, and, consequently, should be made very strong with direct reference to emergencies. In old houses, in which the strength of the boards and joists in the lower rooms has become somewhat impaired by age, or by want of thorough ventilation of the cellar, supports should be placed under the floors of rooms which will be likely to be crowded. These may be easily and cheaply made by using posts at each end of the floor, one end of each to be placed upon a solid stone foundation in the cellar, and the other mortised into a stick four by six inches. This stick should come up tight to the bottom of the joists, and the posts should be supported at the bottoms so that they cannot move in any direction. Where floors are very weak they should be taken up, and new joists supplied. If it is thought that the floor had better remain, and that the supports suggested are insufficient,

a frame, about three-fourths the size of the room, with a four-inch stick in the middle, across the top, running crosswise of the joists, may be used in the cellar. If this is properly made, and put up, it will last a great while, and make the floor perfectly save.

In selecting timber for joists and floor-boards, care should be taken to get that which is well seasoned and which is free from shakes and knots. This because it is important that timber used in either of these positions should possess both durability and strength. It has become quite fashionable to use very poor boards for floors, and then cover the defects with carpets. This does not seem to be in good taste, and it tends to compel men to buy carpets who are not really able to do so. Not every farmer can spare the money required to carpet all his rooms. Better have a floor that will look well itself. Then when the owner is able he can cover it; but there will be no excuse for his running into debt for a carpet. For floor-boards, yellow pine is one of the very best kinds of timber. These boards should be nearly, or quite, an inch and a half in thickness and not exceed four inches in width. If well laid upon a good foundation, this will make a very fine floor of which neither farmer nor gentleman need be ashamed.

In modern houses STAIRS are not only conveniences but are absolutely necessary for the comfort of the occupants. In some houses which we have seen, appearances indicate that the stairs were considered "necessary evils," and were crowded into as small a space and put as much out of the way as possible. While it is very desirable to economize room by using it to the best possible advantage, it is not well to make the stairs too narrow or place them where they will be inconvenient of access. Any one who has had experience in carrying furniture up narrow, steep, or winding stairs will heartily second our recommendation that all the stairways in a house, those from the back-room just as truly as the front-stairs, should be

made wide, straight, with a slow elevation, and with a strong railing at the side opposite the wall. Stairs which rise six feet in a distance on the ground of three feet and a half are an abomination, yet they are often seen in old houses. For women and invalids to climb such stairs is terribly hard, while for children they are still more dangerous. The winding stairs which are frequently used are much better than the old style of steep and narrow ways, but these are quite inconvenient about carrying furniture either up or down. For ordinary farm-houses they are far inferior to the straight, wide, and slowly rising stairs which we recommend. If any reader is tempted to think this a matter of small importance because a farmer does not often change his residence, and, consequently, is not often obliged to carry furniture over the stairs, let him remember that the occasional inconvenience which is almost sure to arise might and ought to be avoided, that a house ought to be so constructed that a man can get an ordinary lot of furniture up the stairs without a great deal of difficulty, and also that in a common farm-house much of the work of the woman who cares for it must be done in the chambers. This work cannot all be done at once, but requires attention at various hours of the day. To go up and down a pair of steep stairs several times every twenty-four hours is enough, of itself, to tire a woman who is not very strong. The farmer who is what he should be desires to have an abundance of labor-saving machinery, and to arrange his work in the most convenient manner possible. He knows that in saving time and strength he is saving money. He ought to be just as ready to arrange the house so that the work of his wife can be easily and rapidly performed, as he is to invest labor and money in securing convenience in managing his own work. One of the ways in which he can aid her is by arranging the stairs so that the labor of passing over them will be reduced to the lowest possible point.

ROOFS.—Whether the roof of a house shall be flat or sloping

will depend upon the style of the house, the amount of room required, and the tastes of the owner. For ordinary farm-houses we do not favor flat roofs. With a given ground-surface they furnish less room than the ordinary style, and we know of no advantage which they possess which can render them general favorites. At the North, especially, where large quantities of snow fall, they need a greater amount of care in the winter than most farmers are willing to bestow. For covering roofs three kinds of material are in very common use, while iron, straw, gravel, and various preparations of felt and tar are employed to some extent. But wood, tin, and slate are principally used by farmers. Various kinds of wood are used and various sizes and styles of shingles are employed. Cedar, pine, and spruce make splendid shingles if no sap-wood is used, and will last from twenty to fifty years. But if a very little of the sap is allowed to remain, the roof will leak in eight or ten years.

It is always economy when buying shingles to get the finest quality, as it costs no more to lay them than it does poor ones, and, as they last from two to five times as long, the cost of several re-shinglings is avoided. Tin roofs, if well made and constantly kept painted, will last a long time; but in most sections the cost is very much greater than that of wood, and on this account tin has not come into general use as a roofing material for farm buildings. Slate, so often seen upon public buildings, is frequently used in NEW ENGLAND and the MIDDLE STATES upon farm-houses and barns. Being close to the quarries, the cost is not excessive, while, if the roof is very strong and the slates are well laid, a very durable roof is obtained. In order to make a good roof with slate, the boards upon which they are laid must be perfectly tight, so as to prevent the penetration of rain and snow when the wind blows, and the rafters must be so strong that no amount of snow which falls upon the roof will deflect them in the least. If the rafters are so weak as to allow the roof to settle, the slates will be pried up as surely as a man

could do it with a crowbar. Being very brittle, they will frequently break when subjected to such a strain. If they do not break, the nails will be loosened and the slates will come off.

When wood is used for roofing purposes the application of some cheap paint has been found an excellent preservative. The shingles to which this paint is applied should be well seasoned, and should be perfectly dry when the paint is used. The presence of sap in the wood, or of dew on the shingles, will cause the paint to scale off in a short time. Various preparations for painting roofs are in the market. Probably the cheapest material is crude petroleum. This is an excellent preservative. Whitewash is often used, but is too liable to wash off. Roofing paints having a large proportion of tar are highly recommended by some, but do not always give satisfaction. Those with slate or asbestos for their basis would seem to be better adapted to the purpose. Whenever roofs are painted, an effort should be made to secure a fireproof article as well as one which will preserve the shingles.

CHIMNEYS.—The old style of building only one chimney for each house, and making that as large as a good-sized room, is extremely bad and should never be followed in a new house. All house chimneys should be of small size and conveniently located. Stovepipes ought never to traverse a long distance from the fire to the chimney. Many farmers in the older settled parts of the country have taken down the immense piles of brick which once answered for chimneys and built new and smaller ones. We never knew a man to regret making this change. The use of a larger number of smaller chimneys gives much more room in the house, much less stove-pipe is required, the draught of the flues is greatly increased, the danger from fire is very much diminished, and the general plan and appearance of the house is improved. Chimneys should be built with the utmost care, and only the very best and most conscientious workmen should be employed in their construction. A great

many houses are burned every year on account of defective flues. It is also well to carry the chimneys to a good height above the roof, both in order to secure a strong draught and also to diminish the danger from falling sparks. They should *always* be built upon a solid foundation in the ground. If the nicest mortar is used it is well to plaster the inside of the chimneys, but a poor quality of mortar will only make a bad matter worse.

EAVE-TROUGHS.—These should be found upon every house. They will enable the owner to secure rain-water if he wishes to, and this, where the well-water is hard, is quite an object. They also make it so much pleasanter going in and out of a house when it rains, that a man who has once had the benefit of one would feel as if deprived of a luxury if it were taken down. But the great benefit of these troughs is to be found in the fact that they keep a vast quantity of water out of the cellar. This would pay for their cost every season. Where there are no eave-troughs there will, of necessity, be a wet cellar. This is both unpleasant and unhealthy. Consequently, troughs should be provided, and should lead either into a cistern, or to some common point from which the water may be taken by another trough to a suitable distance from the house.

BLINDS.—These may be classed among the luxuries, but as they are not very expensive they can be secured by the majority of farmers. Whether they will *pay* or not, each one must decide for himself. They will protect the windows, make the rooms cooler, keep out the flies, and give a finished appearance to the house which it otherwise could not possess. They are among the means for making home more pleasant, and, as such, they should not be despised. When buying it is always best to get good ones, and they should be carefully fitted and hung.

PIAZZA.—A good piazza will add somewhat to the cost of a new house, and involve a still greater expense if attached to an old one. It will give a better appearance to the house, and

make it more pleasant to live in. Climbing vines may be trained upon the posts, and a pleasant place will be provided in which to pass the leisure hour at noon in the summer time, and also many evenings in warm and pleasant weather.

LIGHTNING-RODS.—On account of the many swindles which certain agents have practiced, and also because a great many defective rods have been put up, there is a very common impression that a farmer had better not have rods put on his buildings. But this seems to be one of these cases in which a good article is condemned because a counterfeit has proved poor, or because some evil-minded person has cheated people in its sale. While a poor rod, or a good rod badly put up, or which has got out of order, becomes at once a source of danger rather than a protection from evil, we think the facts in the case will warrant the assertion that a first-rate rod, properly put up, and constantly kept in order, is an almost absolute protection against danger from lightning. We have known the lightning to strike buildings upon which there were rods, but we never have seen a case in which there was loss of life or serious injury to property when there was a good rod, and it was in good order. In buying a rod care should be taken to get the very best one in the market, and to have a first-class workman put it up. The rod should be of nearly uniform size throughout. No rod with small joints should ever be bought. It should rise to a reasonable height above the top of the chimney, and a point should also go up from each end of the building. If the building to be protected is very large, more points will be needed. The height to which the points should rise will depend upon the size of the building, and can be determined by a skilful and intelligent workman. Never attempt to save money by using very short tops, or by placing only a little iron in the ground. In all cases the rod in the earth should be placed deep enough to reach a strata of the soil which will never be dry. If it can be put deep enough to reach a living spring it

will be all the better for its contact with water. If a rod gets out of order, it should be at once repaired. It is to defective rods that the injury to buildings which are professedly protected is generally due. We knew of one case in which the lower section of a rod had been broken, and the owner, instead of getting a new piece, was in the habit of attaching a chain whenever he saw a shower approaching. All such arrangements greatly increase the danger. Better not have any rod than to have such make-shifts as that. But a really good rod, well put up, we consider a great safeguard, and would not be without one on both house and barn.

VENTILATION.—This is a subject of vast importance—one upon which many volumes have been written, and which needs to be kept constantly before the minds of the people. It is the fashion to call farm-houses cold and open structures, and to consider them wholly beyond the need of anything in the line of direct ventilation. That these houses are not as close as many city houses is true, and their owners ought to be thankful for it; but in the whole range of our acquaintance we do not know a single instance in which a farmer in building a house has provided anything approaching adequate ventilation. We know of cases in which an effort has been made to ventilate old houses, but not one in which the ventilation of a new farm-house has received special attention. As a rule, the new houses are more dangerous than the old. They are closer and warmer, consequently the danger is increased. We say *danger* because there is a great deal of danger involved in breathing the impure air with which many of our houses are constantly filled. We can gain some light from a few facts which have been published. Lest our readers should imagine that, because these statistics are taken from cities, they will form no basis for calculations concerning the country, we will say that many careful experiments by scientific men have fully established the fact that, except in the basements and gutters, the air in cities is almost exactly the

same in composition and purity as that of the country. Even in MANCHESTER, ENGLAND, where two millions of tons of coal are burned every year, and the air seems full of smoke, there is hardly a trace of carbonic acid. This discovery led one of the learned investigators to exclaim, "How insignificant are the works of art in contaminating that vast ocean of air that is constantly sweeping over the surface of the earth." This being the case, it is probable, that, in respectable quarters of our ordinary cities, the air is fully as pure as it is in the country, and that, on account of less attention to ventilation, the women and children in our most exposed localities really suffer more from impure air than the better classes in the cities.

To give some idea of what ventilation will accomplish, a simple fact from the mortality tables of one of the great DUBLIN hospitals for infants may be useful. Before any special effort to furnish pure air was made, the death-rate for twenty-five years had been one in six, but, during the next twenty-five years after arrangements were made for thorough ventilation, the deaths were only one in one hundred and four. In our own country, PHILADELPHIA is considered a very healthy city; but, in 1866, it was found that nearly forty per cent. of the deaths each year were caused by impure air—a sacrifice of nearly seven thousand lives every year for want of thorough ventilation. In NEW YORK the deaths by foul air are nearly one-half of the immense number which annually occur. The number of children who are sacrificed to the destroying influence of impure air in the cities and country towns every year is almost beyond comprehension. The vast number of deaths of adults which are caused by consumption are believed to be almost wholly due to foul air. DR. LEEDS, who has given a great deal of attention to this subject, says, that it is as easy to prevent consumption by the use of pure air as it is to prevent drunkenness by the use of water. Cholera, and many other diseases, are either caused, or else terribly aggravated, by impure air. The same is true of many

nervous maladies. While we realize that a great multitude of farmers' wives have lost their health partly as a result of monotonous overwork, we are confident that if the houses in which they lived had been thoroughly ventilated they would not have suffered one-half the ills to which they have been subjected. The farmer and his boys spend much of their time in the open air. Consequently, though they may work hard, they are not as likely to lose health and strength as the wife and sisters who are obliged to breathe a contaminated atmosphere.

When a new house is built, or an old one repaired, one of the great things to be considered is proper ventilation. If the house is in good repair, but there are no suitable arrangements for keeping a constant supply of pure air, the owner should not risk the health of his family by allowing it to remain longer in this condition. Just how to ventilate a house perfectly without involving a great expense is a question over which there has been much discussion. We have neither time nor space to present the many plans which have been proposed and the arguments by which they have been sustained. But some simple suggestions may be made. Windows should be arranged so as to let down at the top. If they were not put in right when the house was built, the difficulty may be readily obviated. A carpenter, or a farmer who uses tools with facility, can very easily make the change. In summer the doors and windows should be freely opened. No matter if the sun does fade the carpet. Life and health are to be considered before carpets and furniture. If there are no other means of ventilation, open the doors right through the house every few hours in winter. It does but little good to merely open a single door or window. For the room is constantly full of air, and while what is in remains no more can enter. We can no more crowd air into a room than we can crowd water into a bottle which is full. When a window is opened to let in air the door or window on the opposite side should be opened to let the foul air out. An old-fashioned fire-

place is a splendid means for ventilation. It allows the impure air to pass up the chimney, and cold air can be admitted by windows, doors, or, still better, by a pipe specially arranged for this purpose. Such a fire-place will also allow from one-half to two-thirds of the heat to escape. This makes it a somewhat expensive arrangement, but, as MR. WARING has well said, this expense is the price which is paid for immunity from disease. But in many of our modern houses there are no fireplaces. The fire in the stove causes something of a draught, and the fresh air comes in around the windows and doors to supply its place. But this is far from sufficient. The best method in such a case seems to be to have a ventilating flue built close to the chimney, so that the heat of the fire will warm the air in the flue and cause a draught, with an opening near the floor for the escape of foul air, and a pipe with one end in the external air and the other immediately over, or almost against, the stove. Or, the fresh air may be admitted at the top of the room if there is an opening at the top on the opposite side for the escape of the impure air. It was once supposed that the impure air would be found at the top of a room and the purer air near the floor, but it has been found that, except when unusually heated by gas, or lamps, much of the foul air will descend, as the carbonic acid is heavy, and will be found near the bottom of the room. Even in houses which are old and have many cracks around the windows and doors, there should be a systematic effort to secure ventilation, because when air comes through so many crevices the inmates of the room will be very likely to take cold, while, if an opening is made which is larger than the sum of all these cracks, and the air is conducted to the stove, the danger from this source is avoided and there is a greater certainty that an abundance of fresh air will be secured. Certainly, in some way, even though the cost of fuel should be increased, plenty of pure air should be supplied to every room of each and every farmhouse in the country.

VARIOUS INTERIOR ARRANGEMENTS.—We have already called attention to the importance of having the rooms so arranged, that as little useless travelling as possible will be required. If the rooms were properly arranged, the work of some house-keepers would be greatly diminished. In new houses the rooms can be adjusted easily enough, but in one already built some changes may be necessary to secure the greatest efficiency and economy of labor. In some cases a change of the parlor to the uses of the kitchen, and the kitchen for the parlor, will give great relief. The kitchen and sitting-room ought to be the pleasantest located rooms in the whole house. In "HOMES, AND HOW TO MAKE THEM," MR. GARDNER well says that as the kitchen is the chief workshop of the house, it should be close to the dining-room, and "fitted up and furnished precisely as an intelligent manufacturer would fit up his factory. Every possible convenience for doing what must be done, a machine for doing each kind of work and a place for every machine. Provision for the removal and utilizing of all waste, for economizing to the utmost all labor and material, should be made." Not only as a matter of convenience for the farmer's wife, but also to promote the comfort and health of the whole family, a dining-room should always have a place in the farm-house. There should be a "back-room" in which the washing can be done in hot weather, and which can be used for many purposes to which no other room is well adapted. A large arch kettle should be located in this room. This can be used for cooking vegetables for stock, and will be very "handy" many times. A play-room for the children, which, when they arrive at a suitable age, can be converted into a work-room for the boys, ought also to be provided. A room in the attic will be found very convenient as a place for drying clothes in bad weather. There should be a window at each end in order to secure a circulation of air. The sleeping-rooms need not be excessively large, but should be of sufficient size to admit of the easy performance of the work

which it is necessary to do in them. Many persons have an idea that all sleeping-rooms should be very high and large; but DR. LEEDS has shown that if they are well-ventilated, rooms of moderate size will do very well, while no possible amount of size and space can render them safe for sleeping apartments if ventilation is neglected. The various rooms of the house should be well supplied with closets and cupboards, as these will add greatly to the convenience of doing the necessary work for the family. In order to render the house-cleaning as easy as possible, the wood-work in the rooms should be varnished. The difference between cleaning wood-work which has been merely painted and that which has been painted and varnished is greater than would naturally be supposed. It costs but little to do the varnishing, the paint will wear much longer, and the room will look much nicer for its application.

Very near the kitchen there should be a room for the storage of fuel. This may be the wood-shed, devoted wholly to the purpose of keeping the wood from injury by exposure to the elements, or, if this is at a little distance from the house, merely a small room in which a supply of dry wood and kindlings can be constantly stored. Something of the kind ought always to be provided, and plenty of good fuel should be constantly at hand.

THE CELLAR.—It was once the fashion to build a very large house, set it nearly on a level with the ground, and have a deep cellar under the whole. Fortunately this style has been greatly modified. Houses are smaller, are set up higher from the soil, and there are cellars under only about half the surface covered by the buildings. Very large cellars are almost sure to become a place of storage for a great deal of waste material, which slowly decays and gives off poisonous gases, which seriously injure the health of those who occupy the rooms above. It is considerable work to properly care for a large cellar, and it is not needed on a farm.

Sometimes the house-cellar is made a place for storing large quantities of roots for cattle, but this should never be done. The cellar should be thoroughly drained. Even very dry land is almost sure to be wet, or damp, after heavy rains. Consequently a drain is needed in the driest of cellars. Where the land is wet, MR. WARING recommends the laying of drain-tile a foot below the bottom of the cellar, and the same distance inside the walls. These tiles to go around the cellar, and be carried into a tile-drain which shall take the water a suitable distance from the house. The bottom of the cellar then to be covered with stones, and cemented. This is a good and not very expensive method for accomplishing a very desirable result. Where stones cannot be used for the bottom and walls, bricks may take their place. The cellar should be the same size as the house one way, in order to secure easy and perfect ventilation. The turf under the remainder of the house should be taken off, gravel thrown in, and covered with cement in order to prevent the gases, which will otherwise come from the soil, making their way into the rooms. If this is not done the underpinning should not be close, but large spaces should be left each side so as to allow a free circulation of air. Some provision for ventilation should also be made when the ground is cemented. Otherwise the timbers and floors of the house will soon be affected with dry-rot. The cellar-walls should be thick, and carefully cemented all around. Overhead the room should be covered with lath and plaster as neatly as a kitchen, and both the walls and the top should be occasionally white-washed. Several windows should be provided, and they should be so arranged that they can be easily opened and closed. These windows should serve the double purpose of furnishing light and a means of ventilation. There should be stairs from the kitchen, or a point close by, and another set of large and wide ones leading out of doors. If it is impossible to have the bottom cemented in the manner noted, an ample drain should be

provided. Both light and ventilation should always be secured. Dark, damp cellars are not only a cause of much ill-health, but they are also very bad places for the storage of family supplies.

THE BARN.—To a foreigner it must seem very strange that the NEW ENGLAND farmer who has but fifty or a hundred acres of land, much of which is not very productive, should build a large, nice barn, while the WESTERN farmer, who owns a large tract of richer land, has either a very small barn or else none at all. While at the WEST and SOUTH barns seem to be regarded as luxuries, the farmers at the EAST consider them absolute necessities, and expend large sums of money in erecting them. In this respect we think the NEW ENGLAND custom much the best, and we are glad to see indications that the value of barns and granaries is becoming better understood in the other sections. Probably the expense of construction has had much to do with the general neglect to furnish barns in some quarters, but we must think that their benefits have also been underrated. For if the energetic men who have carried on extensive farms, and been successful in their business, had realized the great value of barns, their own farms would not have been so long without them. Within a few years many barns have been erected, and the owners have rejoiced that they were led to build. The best farmers are not only building barns for themselves, but are advising others to follow their example. An editorial article upon this subject, in a late number of COLMAN'S RURAL WORLD, said that "One of the first indications of an enterprising farmer is a good barn," and declared that good farming cannot be carried on without it. To show that there is no necessity for the farmer to do without a barn, the writer said: "If farmers would undertake the building of barns themselves, and not depend upon some number one carpenter to do it, we should have more of them. We built a very commodious barn, sixty feet square, a couple of years ago, with men hired at fifteen dollars per month. The timber was

got out of the woods. The clapboards for shingles were rived in the woods. All the lumber bought was the planks to enclose it. The cost of the whole barn was trifling in comparison to its value, and the amount saved by it any year would build another like it." We have made the above extract in order to show that large and influential farmers find that a barn is a very valuable building, and may be made the means of saving a great deal of money. There is no need of arguing that hay and grain which is promptly stored in a good barn is in a much better condition than it could possibly be in the stack, and that storage in a barn will prevent a great deal of waste in quantity as well as damage in quality. Probably no farmer who has ever had a good barn would willingly be without one for many times its cost. The extract we have made also shows that farmers who have woodland can put up barns at very small expense. Not every one could build as cheaply as the writer of that article, for it is not every farmer who understands the use of tools well enough to enable him to build without more skilful help. But when a good carpenter is hired to frame the building, the expense of construction need not be heavy if the farmer will attend to the work himself, and hire other help to good advantage. Not that a workman should be ground down in his wages. Better do without a barn than to build one with miserably paid labor. But in almost every town there are farmers who were once carpenters, or who can use tools with skill enough for all common work, who do not value their services very highly, or who would rather work on a barn than on the land, and who would be glad to work for a trifle more than farm-laborers receive. When such help can be employed the cost of a barn will be very low. But when circumstances are not as favorable, we are confident that, in the end, it will pay the farmer well to have one. Fig. 5 represents a cheap barn with a baling-press conveniently located. The plan was furnished by P. K. Dederick, Esq., of Albany, N. Y.

The size of a barn must be governed by the size and productiveness of the farm, and the method of finishing should depend upon the financial ability of the owner. We are strongly in favor of baling hay, and thus saving barn-room to a great extent. A press for this purpose is somewhat expensive, but will be much cheaper than a large addition to the barn. A medium-sized hand-press might be obtained for a moderate sum, or several neighbors might buy a power-press in company and use it together, thus reducing the individual cost to a very low figure. With a good press and horse-power four men and two boys will bale, weigh, and store from six to ten tons of hay

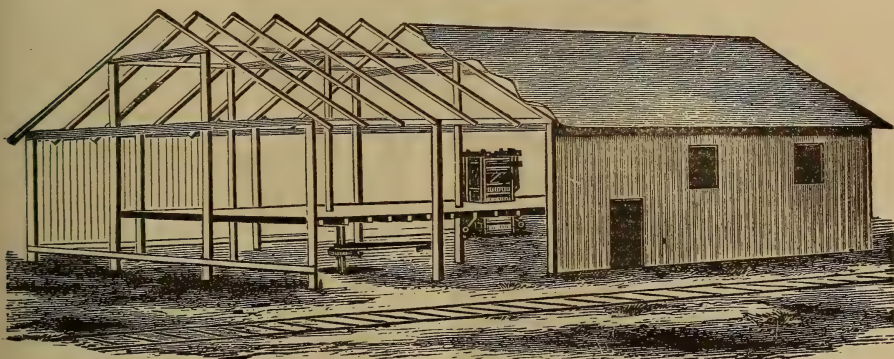


FIG. 5.—CHEAP HAY-BARN.

per day. The cost of baling, including ties, will be only about a dollar and a quarter a ton. Straw can also be baled, and thus put into a fraction of the space which it would otherwise occupy. If either hay or straw are to be sold, baling will greatly facilitate the handling of the materials, and will also admit of their being shipped on the cars. Not only is much room saved by baling hay, but the hay is much less liable to injury by contact with the air, and to loss by scattering around the premises. In some places men who own presses go out baling hay and straw for a certain price per ton. When there is a good press in the neighborhood which can be hired, it may not pay the farmer to buy one, but a great many farmers can afford to

buy, either singly or in company with others, much better than they can afford to do without. Figure 6 represents the "Ingersoll" hand-press, manufactured by James N. Balston, Green Point, L. I.; and Figure 7, Dederick's "Perpetual" power-press, made by P. K. Dederick & Co., Albany, N. Y.

In several respects what was said concerning the house will apply with but slight modification to the construction of the

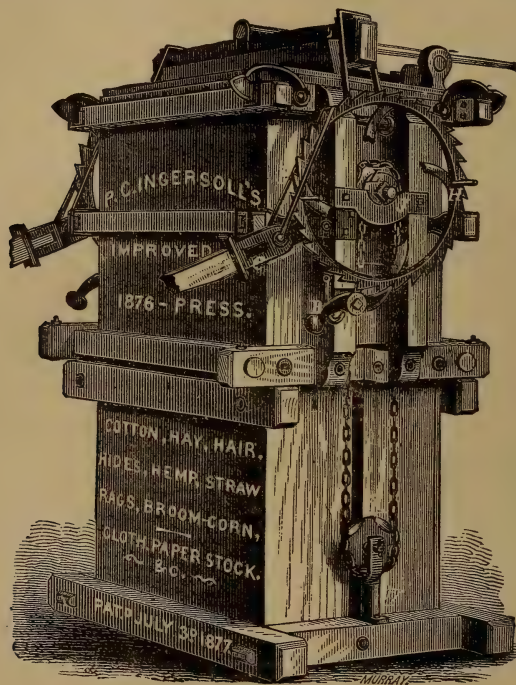


FIG. 6.—INGERSOLL PRESS.

barn. In most parts of the country warmth is one of the great benefits to be obtained. This should be secured by close and carefully lined boarding, tight floors, and well-fitting doors and windows. In NEW ENGLAND there are a great many barns which are so loosely boarded that the air comes in through a multitude of large cracks; the floors are laid so loosely that there are many strong currents of air rising in the stables whenever the wind blows, and the roofs are so open, and the doors

and windows fit so poorly, that in a cold or stormy day they very forcibly remind one of a house built of boughs in the woods. Such barns are not only very uncomfortable for animals which are kept in them, but are also very expensive structures for their owners. Cattle which are constantly cold will be terribly hungry, and it will cost much more to keep them than it would if they were warm. Much of the food which they eat in cold weather will be used to keep up the animal heat. If more than sufficient for this purpose is furnished, the waste of the system will be supplied; but if not, the animal will grow poor. If there remains any nutriment after these ends have been

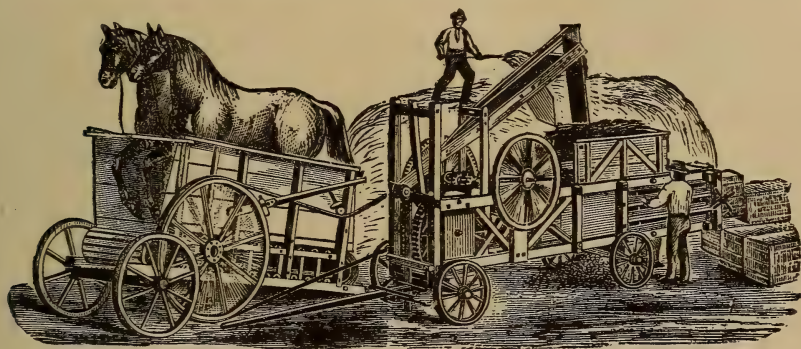


FIG. 7.—“PERPETUAL” PRESS.

secured, the surplus will be used to fatten the animal, or answer other productive purposes. Before a cow can give milk she must have food enough to keep her animal heat up to a certain point, and also supply the waste which is constantly going on. These things have the first claim in the animal economy. If a cow gives milk without having sufficient food to answer these requirements, she will do it at the direct expense of her system, and will inevitably grow poor. Men who have made a business of feeding cattle have found that a certain quantity of food will produce a much larger proportion of meat if the animals to which it is fed are kept warm, than it will if they are exposed to storms and severe cold. Farmers are well aware that when

they are out in the woods in winter they need more food than they do when they remain by the fire. The greater the exposure to cold the greater will be the waste of animal heat, and the larger the quantity of food which will be needed to produce heat enough to keep the system at its normal temperature. The same principle applies to animals. This makes it plain that to quite an extent warm stables will take the place of food. Cattle must in some way be kept warm enough so that they will not freeze. Shelter can do much toward keeping up the animal heat, and food is able to do the rest. If shelter is denied, a double burden is thrown upon the food, and a much larger quantity will be required than will be necessary if sufficient shelter is provided. The man who has a warm barn can keep more cattle, and keep them in better flesh, than another who feeds the same amount of hay in a cold barn. Merely in order to prevent the suffering which severe cold brings to all domestic animals in our Northern States, the barns should be made warm, and the claims of the owner's pocket will strongly second those of pure humanity.

Some of the means of promoting warmth have been noted. In case it is desired to fill under the stables with muck in order to save the liquid manure, the floors should be laid with a little space between the planks, but all upward currents of air should be prevented by having the walls under the sills perfectly tight and by keeping a suitable quantity of muck in the vault. But, while warmth is greatly to be desired, ventilation must not be neglected. Better have a cold barn in which there is plenty of pure air than a tight, warm one in which the animals are obliged to constantly breathe a badly tainted atmosphere. The air in some close stables is terribly offensive, and no animal can remain healthy if obliged to breathe it for any length of time. Upon the top of every well-covered barn there should be a good ventilator, and there should be an opening near the floor for the entrance of pure air.

The doors which lead to the main floor should be wide and high, and should be nicely hung on rollers or hinges. There should be a way for safely locking all the doors in the barn, and also for fastening them open when this is desired. The stable doors should be of ample size and nicely put up. Windows should be furnished in abundance. Nearly all barns are too dark for the comfort and health of the cattle and for the convenience of the men who take care of them. Both horses and cattle are injured by spending their days in dark stalls.

Instead of the ladders which most farmers delight to use in their barns, there should be good stairs leading to the scaffolds and beams. For transient use, a portable step-ladder is much superior to the old-fashioned styles. Floors should be laid in all the "bays;" they should be tight, and elevated at least two feet from the ground. The wall beneath the barn should be tight nearly all the way, but a place should be left upon two opposite sides for ventilation. Between the underground part of the barn and the stables there should be a tight wall. The main floor should be smooth and nicely laid, the stable floors very strong, and both planks and sleepers should be renewed before they are seriously weakened by use or age. The floors upon the scaffolds should be tight and lined in order to prevent the penetration of dust and dirt into the stables, while upon the "great beams" small spaces may be left between the boards in order to facilitate the drying of the grain which is stored upon them.

The roof of the barn should be kept in good repair in order to prevent injury to the framework of the structure, damage to the crops stored within, discomfort to the animals, and loss to the owner. Eave-troughs should always be provided in order to keep the large quantity of water which falls upon the roof from running into the yard. We also consider a lightning-rod almost indispensable.

THE STABLES.—Even at the SOUTH, where the cold does not

compel stock-owners to house their animals, it is advisable to have plenty of well-arranged stables. It is better for the animals to be made tame by coming to the stables, and they will not waste half the food if kept in them that they will if fed on the ground. In cold climates stables are great necessities. They should be an integral part of the barn itself, and kept as warm, light, and well ventilated as any part of the building. The animals which are kept in them should not be crowded. Room is essential to their thrift and comfort as well as to the convenience of the man who takes care of them. Very few stables which we have seen were high enough. All stables should be built so that a tall man, with a tall hat on his head, can go through them without stooping. In every barn in which stock is kept there should be a few box-stalls, each one so arranged that a single animal can be turned in loose if desired. These stalls are very convenient for sick animals, for cows when they calve, and at many other times they are much better than ordinary stables. We do not favor very many stalls in one room. Between every half-dozen stalls there should be a partition with a door which can be securely fastened.

The principal methods of fastening cattle are the stanchion, the chain around the neck, the bow around the neck and passing through a ring which slides upon a round post, and the rope around the horns. Of these the former is considered the surest fastening and is much the most convenient for the man who cares for the stock, but it is not as easy for the cattle as either of the other methods. The chain is an easy and pretty safe fastening. A good bow will usually hold and is not troublesome to the animal, though inconvenient for the man who uses it. The rope is inconvenient, soon wears out, and is liable to be broken, but if cattle are quiet it is not a very uncomfortable fastening. All mangers should be built up from the floor high enough for the cattle to eat from them with but a very slight lowering of the head, should be perfectly tight, and as smooth as possible

inside. They should be so nicely fitted that dry meal can be fed in them without a particle of waste.

THE BARN-CELLAR.—We are not strongly in favor of a barn-cellar—not nearly as strongly as we were a few years ago. These cellars have many manifest advantages, but are also open to grave objections. The cellar can be made a splendid place for the manufacture of manure; but unless a great deal of care is taken, the air which the cattle must breathe will be contaminated, and a source of ill-health both for animals and for the inmates of the neighboring houses will be provided. Decomposition of manure directly under a barn will be almost sure to prove injurious to the animals which are kept in it, and will also injure the quality of the hay and grain which are stored in the building. Any ordinary system of ventilation will prove only a partial and a very inefficient remedy. If means are taken to prevent the decomposition, they will probably be only partially successful, so that the evil will be modified instead of removed. But by taking such a course the farmer cuts himself off from the principal advantages which are claimed for the barn-cellar. It is a significant fact that many intelligent farmers who once considered the manure-cellar a very valuable adjunct to a barn have given up using it for the purpose for which it was originally designed. The opinion seems to be gaining ground that while a barn-cellar is a splendid place for the manufacture of manure, it is subject to serious drawbacks which more than equal the good which can result from its use. In all cases, if a cellar is used, a great deal of care should be taken to keep a constant and an abundant supply of dry earth, or some powerful deodorizer, on hand, and by its use prevent, as far as possible, the evil effects which result from the presence of fermenting and decaying material directly under the cattle, and in the vicinity of hay and grain.

On farms upon which large quantities of roots are grown, a cellar under the barn may be the best place for their storage

which can be obtained. The bins should be under the main barn and never directly under the stables. When the barn is built upon a side-hill, a basement-room can sometimes be easily secured. This will provide a place for roots upon one side and stables upon the other. The stables should be upon the ground-level, and the whole length of the basement should be exposed to the light and be well ventilated. Dark, damp, and badly ventilated stables are terribly unhealthy. When the stables are over a cellar the floors should be made very strong, frequently examined, and constantly kept in good repair. Many cases are on record in which animals have been killed by the giving away of the floors upon which they stood. When cattle are kept in the basement, it is also important that the floors overhead should be laid upon strong timbers and be kept in good repair.

THE GRANARY.—We have already alluded to the great importance of having a granary. * A room finished off in the barn, or over the wagon-shed, though often made to answer the purpose, is not a satisfactory substitute for a building devoted to this special purpose. The granary may be a very simple structure, but it should be an independent building. The size and the details of construction will vary greatly with the requirements of different farms, but there are a few general principles which should be universally regarded. The building should be set upon stone posts, or a smooth brick-wall, which should rise at least three feet above the level of the ground. This is one of the most effectual methods for keeping rats away from the grain. If walls are used, spaces should be left to allow a circulation of air under the building. Two sides of the granary should be covered with slats two and a half or three inches wide, and placed half an inch apart. The other sides should be boarded perfectly tight. The eaves should project considerably and the roof be kept constantly in repair. The floor should be made of planks closely fitted and smoothly laid. There should be at least two windows to admit the light, and a ventilator should also be pro-

vided. Against the sides covered with slats, bins for holding ears of corn may be built. These should not be more than three feet wide, but in height may extend nearly to the roof. Against the sides covered with boards bins for wheat, oats, and shelled-corn, may be constructed. These should be perfectly tight, with well-fitting covers and provided with locks and keys. Bins for this purpose should not be more than three or four feet wide and four feet high. They should be divided off by partitions into several compartments, each holding from ten to forty bushels of grain. We do not like the idea of a second tier of bins above the one on the floor. We should much prefer to put up extra bins, from the floor, in front of the others, with an alley three feet in width between. Over these bins, and high enough to allow the covers to be raised without obstruction, a scaffold may be built which will be found very convenient for various purposes.

Access to this scaffold may be had by means of stairs. A step-ladder should also be provided for use in the granary, and provision ought to be made for temporary stagings to be put up in husking time and removed when the corn-bins are filled. The outside door should be made to close perfectly tight and should be provided with a strong lock.

THE HOG-HOUSE.—Concerning this building little need be said. It should be warm, with plenty of windows to admit the light, and ample means of ventilation. The roof should be high enough above the floor to allow a tall man to stand upright in the pens. The building should be divided into two or more apartments connected with each other by a door, and each pen connected with the yard in the same way. In front of the pens there should be a wide alley which should always be kept clean instead of being, as is too often the case, made a storing-place for tools, old barrels, odd pieces of boards, and all manner of rubbish. The boarding between the alley and the pen should be high enough to prevent all attempts on the part of the pigs

to jump over. There should also be one or two boards laid across the front of the pen, directly over the trough, to keep the pigs from jumping up and putting their forward feet near the top of the boarding, thus throwing mud in the face of the man who feeds them. Without some preventive, pigs will soon learn to jump up when any one comes to feed them, and will make the operation of feeding them one of the most vexatious tasks which the farmer has to perform. The lower boards of the partition between the pen and the alley should be so arranged as to be swung inside the pen, leaving the trough in the alley, while the food is being put in. This will allow the troughs to be properly cleaned as well as add to the convenience of feeding the pigs. The floor of the pen should be made of planks, well fitted, and nailed down. Otherwise the pigs will be likely to tear it up. In order to keep it dry the floor should slope a little toward the yard. In one corner should be a room, divided from the main pen by a partition six inches or a foot in height, for the pigs to use as a sleeping apartment. Plenty of straw should be kept in this corner. When the bed becomes foul it should be thrown out and fresh straw supplied.

If the raising of pigs is one of the industries to which the farmer devotes his attention, larger pens will be needed than will be required for simply fattening hogs. The building must not only be larger but finished in better style, and in the Northern States supplied with a stove and other conveniences. It is well to give pigs plenty of room in which to eat and sleep, as well as a good-sized yard. For ordinary purposes a house need cost but a small sum, and even where the raising of pigs is to be a prominent business the expense need not be very great.

THE HEN-HOUSE.—This may be a small and inexpensive building, but something for the purpose should be found upon every farm. For, in spite of all the mischief which they do, hens and chickens can be made to pay well for all the expense and trouble of growing and keeping them. But, like all other

animals, they need food, and care, and protection from cold and storms. They ought not to be compelled to roost in trees, or on fences, or in wagon-sheds, but should have a house of their own just as much as the hogs or the sheep. This house should be set high enough above the ground to avoid dampness and be closely underpinned, with spaces for ventilation as described for the preceding buildings. The size must depend upon the number of fowls to be kept. A house ten by sixteen feet is large enough for thirty or thirty-five fowls. Whatever the number which is to be kept, the farmer should remember that it is not safe to house more than fifty fowls in any one apartment, even though it be a very large one. If more than this number are to be kept, more than one room should be provided. The roof should be high enough to allow a man to stand upright in any part of the building. In order to save expense the roof can be made upon one side, having the other side of the building perpendicular from the ground to the top of the roof. Or, if only a small room is wanted, the upper end of the rafters may be laid against one end of the wagon-shed, or some other building. The floor should be made of matched boards, cement, or clay. The room should be closely boarded on three-inch studs and lined with matched boards, or else with lath and plaster. The inside of the roof should be covered in the same way, and the outside covered with the best shingles or with slate.

The south side should be largely of glass, and there may be windows in other parts of the building if desired. A good ventilator is one of the necessities, and must not be omitted. One or more good-sized doors should be provided, and should be furnished with good locks. The interior arrangements may be quite simple. There should be a few boxes for nests, and a sufficient number of perches to accommodate all the fowls. Also a box to contain dust, and another for gravel. A large iron dish, or something which will answer the purpose, should be furnished to contain water for drinking purposes. The whole

interior of the building should be whitewashed three or four times a year.

THE WAGON-SHED.—This may be a plain building, but should be closely boarded and lined, and always kept well shingled. The size will depend upon the number of wagons and carts which are used on the farm. On very small farms it is sometimes well to make the lower floor of the wagon-shed also answer the purposes of a tool-house. It may also, upon such farms, do for a horse-barn besides. The loft overhead will furnish a place for the storage of plenty of hay, and room for a stable can easily be secured on the lower floor.

On large farms this arrangement should not be made. The ground-floor should be reasonably tight, and the floor over the wagons should be lined so as to prevent the entrance of dust into the lower room. Many sheds are left open in front, but we think it better to have doors. Certainly the sheds in which the nice wagons, carriages, and robes are kept (which should always be separated by a close partition from the rest of the building) should have doors which can be locked, and in which things can be safely kept. This building should be raised but little above the surface of the ground, as it would be hard work to draw in the wagons if it were much higher than the land around it. There is a strong tendency to make wagon-sheds too small, and thus convert them into perfect nuisances.

For a small farm a building thirty-six feet long, and twenty-eight feet wide, with a partition running through it lengthwise two feet one side of the centre, will answer very well. This will give one room thirty-six by sixteen feet, which will afford space for five wagons or carriages, with room to pass between them in getting in and out, and another room thirty-six by twelve feet, which can be used for the storage of the mowing-machine, hay-tedder, horse-rake, plows, harrows, shovels, and other tools. It is best to have a partition dividing each of these rooms. In one corner a room fourteen feet wide, inside of the posts, may be

done off for the best wagon and the top-carriage. This should be at least eight and a half feet high, so that it will take in a high carriage without letting down the top. If it is desired to save all possible expense, the other rooms, in which tools and wagons are kept, may be left open in front, but it is much better that the whole building should be enclosed. The height of these rooms need not exceed seven feet, and should not fall much below that figure. If such a building contains more room than is desired for the purposes named, the remainder may be utilized for a horse-stall as already suggested. If preferred, a stable for a few sheep may be furnished instead of the horse-stall. The loft will give plenty of room for the storage of rowen upon which to feed them during the winter.

The posts for this building should be thirteen feet long. This because the ground size proposed needs this height, in order to make a well-proportioned building, and also because the cost will be but a trifle more than it would if short posts were used, while the loft, which will be found very useful, cannot be secured of suitable size without posts of about this length.

THE WOOD-HOUSE.—This may be a very simple building, but should always be provided on farms where wood is used for fuel. It should be very near the kitchen, unless a special wood-room is done off in the house, and access to it should be had without going out of doors. In any case it should not be far from the dwelling. The size will vary with the size of the family, number of fires kept, and quantity of wood which is used. It should be large enough to hold rather more wood than is needed in any ordinary year. This, too, without building the piles much higher than a man can reach comfortably when standing on the floor. There should be a tight floor over the wood-room. This may be reached by stairs, and will furnish a good place for the storage of many things which are often needed on the farm, and for which there seems to be no other convenient location. The

buildings should be closely boarded and the roof kept in good repair. The wood ought never to be laid upon the ground; but a good floor should be provided for the whole building. The front should be made of doors which can be opened when desired, and there should be one or more windows to admit the light.

CLOSETS AND VAULTS.—Not one farmer in a hundred is so situated that he can have the water-closet which is in common use in cities,*but this is no reason why the great majority should furnish only small, leaky, inconvenient buildings, located so far from the house, or in such badly exposed situations, that the women and children will never go to them when it is possible to prevent it, or will be obliged to run the risk of catching a severe cold every time they venture there. No small amount of ill-health is caused in this way every year. But there are two other, and great, sources of danger connected with the ordinary closet as found on the farm—sources from which thousands of deaths result every year, and by which the seeds of disease are sown in the systems of thousands who do not at once succumb to the evil, but baffle it for a while, yet only in a multitude of cases to be defeated in the not distant future. These are the fouling of the air and the poisoning of the water. Many of the closets have no means of deodorization, and no effort is made to prevent the liquid portion of their contents from passing freely into the ground. In the former manner the great majority of these closets work an immense amount of mischief, but an amount which they would greatly exceed in the other respect, were it not for the fact that they are located so far from the houses and wells. But many of them are near enough to wells to taint them and work deadly mischief. The earth possesses the power to filter poisonous liquids to some extent, but this power is gradually lost, and in time the soil becomes filled with poison and then cannot purify the water passing through it. Thus it happens that there is seldom trouble with the well at a

new house. Even though the closet may be dangerously near, the soil, for a while, wards off the evil. But the time comes when all the earth between the closet and the well is foul, and the day of reckoning is then at hand. The inmates of the house mysteriously (to them) lose their health. Headaches, neuralgia, liver troubles, blood-poisons, and typhoid fevers, become frequent and dangerous visitors. The doctors are called and medicines are poured down. As the invalids drink but little cold water a temporary relief is obtained. Those who drink water only after it has been boiled partially escape. But ill-health is the rule, and untimely deaths will be almost sure to occur. That terrible scourge, diphtheria, is often caused by foul wells and a poisoned soil. Probably not one farmer in a thousand realizes the tremendous danger attending these old-fashioned closets. If far from the house, they are, in bad weather, practically inaccessible to the women and younger children; they foul the air, and if located above the level of the house and the soil is porous, a communication is soon established with the well. If near by, the air is poisoned and the water is soon spoiled. This is a terrible evil. Physicians realize it, but there are few men who have not made a special study of the matter who have any adequate idea of the amount of the evil which has already been accomplished, or the danger which is lurking in the present and the future. But all this evil can be avoided in new places and remedied in old localities. But little expense need be involved. Care and skill are the main requisites. The closet should be placed in some spot which is sheltered from the storms and hidden from the road. It should be reached without going out of doors. If this is impossible, thick rows of evergreens, or a high, tight fence may serve as a wind-break, and also shield the passer from observation. The vault should be cemented upon the bottom and all its sides. Dry muck, road dust, or coal-ashes, should be used every day as a deodorizer and absorbent.

The closet should be large enough to hold two or three barrels of this material. From two to four quarts of either of these substances thrown down every day, half in the morning and the remainder at night, will keep the air pure and prevent all danger of injury to the well, if the latter is not too near by. If at any time an odor should arise, more dust must be thrown down. No soap-suds, or slops of any kind, should ever be turned into the vault. The closet should be set upon a cemented wall a little above the surface of the land; the back walls should slope a little, projecting farther at the bottom than the top, and the vault be closed by a plank-door coated with gas-tar on the inside, and painted on the outside. This door should be hung on hinges so that it can be readily opened, and a hook should be provided to keep it up when necessary to clean the vault. The door must also be so hung as to fit the projecting walls, hold down by its own weight, and shut perfectly tight. With such simple and inexpensive arrangements as these, the terrible evils which have been pointed out, and from which thousands of farmers' families are reaping a harvest of disease and death, may be avoided. But there must be no neglect. The deodorizer must be used every day. In addition to keeping the air and water pure, this plan also obviates all difficulty in clearing out the vaults, as the contents will be perfectly inoffensive.

THE TOOL-HOUSE.—Upon large farms there certainly ought to be a building devoted expressly to the storage of tools and machines. The spare room in the wagon-shed, which has been indicated for this purpose on small farms, will be wholly inadequate on large ones. That wagons ought to be fully protected from the weather the majority of good farmers understand. But many of the tools and machines in common use upon large farms are as valuable as ordinary wagons, while some of them are much more expensive. It is utterly ruinous to allow reapers, mowers, hay-tedders, grain-drills, plows,

harrows, and similar implements, to remain exposed to the destructive influences of the weather. A plain, cheap building should therefore be erected for their preservation. This should be located near the barn, so that no time and travel shall be lost in getting the teams to where the tools are kept. The size of the structure should depend upon the number of implements in use upon the farm. The building should be tightly covered, provided with windows, and have plenty of doors which can be securely fastened. A good floor should be made a little above the ground. This can be made of a low grade of planks so that its expense will be light. It is not well to have machines stand upon the ground, as there will inevitably be a dampness arising from it which will rust the iron wheels and gears and swell the wood-work. About seven feet above this ground-floor should be a scaffold, upon which rakes, forks, baskets, and many of the lighter implements in use upon the farm, may be stored. This floor should be perfectly tight, and be reached by stairs on the inside of the building. Pegs, nails, and shelf-room should be provided in abundance, and there should be plenty of room for the storage of all implements for which no more suitable place has been supplied.

THE REPAIR-SHOP.—This is also a great convenience, almost a necessity, on a large farm. Tools are constantly getting worn, or broken, or loosened, or need cleaning, or painting, or some simple repairs. If he had a good place in which to do it many a farmer might repair a large part of his tools, and if this work were done as soon as needed, a vast amount of money would be saved. It is now too often the case that machines are run as long as possible and then sent off for repairs. In this way the tools are badly injured and great expense is incurred. A farmer who is handy with carpenters' and blacksmiths' tools could attend to these matters at once and thus save both the wear and the expense. There will be many jobs which he cannot do, but he will find many more which he can perform, and by doing

them he can save much time and money. This shop may be a plain, closely boarded, well-lighted, one-story building, with a loft for storing boards and light pieces of timber. There should be a doorway wide enough to take in a farm-wagon or hay-tedder. There ought to be a good floor, a work-bench on one side with racks and shelves to hold the tools, two or three good horses upon which planks or farm-tools can be laid, while a forge, and a good lathe, will add greatly to the completeness of the structure. In this room mowing machines may be cleaned and oiled, wagon-bodies painted, wheels and axles repaired, rake teeth put in, and a large number of small but necessary jobs performed. In order to make the room comfortable in winter, when much of the repairing should be done, a small, tight stove should be put up, and the pipe, as also the pipe to the forge, if one is used, should go into a substantial chimney. This building should be located near the house, but in such a position that there will be no danger to the other structures from the sparks which may escape from the chimney.

THE STORE-HOUSE.—This is also a great convenience upon large farms. It should be located near the house, and may be very plain, but should be closely boarded, well lighted, with a wide door and a strong lock. In this room bins should be made, clean barrels stored, and shelves placed against the walls. The floor should be about two feet above the ground, so as to guard against dampness, and very closely laid. The size and shape of this building must be modified by the wants of the owner. On small farms this structure will not be a necessity, though it would often prove a great convenience. It would furnish a place for the ripening and curing of fruit, the drying of nuts, and the storage of roots during the fall, as well as answer a multitude of other purposes.

We have treated the subject of farm buildings at considerable length because we believe it to be one of great importance to the farmer. Without suitable buildings his health, the health

of his family, and the thrift of his stock, will be sacrificed; his crops will be damaged by exposure to the elements, and his whole business will be carried on at a great, and constantly increasing, disadvantage. The buildings need not be costly. Mere ornament is not required. If it is necessary to practice a close economy, let that economy be exhibited in other directions, but not in the form of neglect to provide suitable buildings for the protection of the fruits of the farmer's toil. Plain, substantial buildings are a great necessity, and no farm can be profitably managed without them. The attempt to do without them shows a want of appreciation of their benefits, and is usually an indication that a "penny wise pound foolish" policy is being pursued

THE CAPACITY OF A FARM.

THE actual rate of production is not, in all cases, an accurate standard by which to measure the productive capacity of a farm. There are a great many farms which are not now producing anything like the quantity of hay and grain which might be grown upon them. Probably the great majority fall far below their possibilities for production. On the other hand, a few have been made, by high cultivation and the use of excessive quantities of stimulating manures, to exceed their natural capacity. Consequently, a stranger can form but a very imperfect idea of the real value of a farm by its appearance. Some men have boasted that if they could see the crops growing they could tell pretty nearly what the farm would do. But this alone will do nothing towards determining the question. We have seen splendid land, which was capable of producing large crops, which was almost barren, while, within a short distance, there was a very poor farm which was growing extremely large crops. A stranger who should judge merely by the appearance of the crops would be almost

sure to be deceived. The manure which is applied and the cultivation which the land receives does far more toward determining the quantity of the crops than the mere capacity of land. The best of land may be so badly cultivated as to appear almost worthless, while land which was naturally poor has been made excessively rich. A stranger seeing the crops on these two fields would be almost certain to call the good poor and the poor good. It would not be safe for him to reason that because the poor land had been brought up to a high rate of production therefore it must now be good. Just as well say that because a man is very strong while wild with a fever he will be strong as long as he lives. His unusual strength is caused by his disease. As soon as that leaves him he will be as weak as a child. So it is with land which has been forced to an unnaturally high rate of production. There is no more productive power in the land than there was before large crops were obtained. These crops were the result of high manuring and extra cultivation. Just as soon as these cease the large crops will become things of the past. Consequently, in buying a farm the mere condition of the crops should not be allowed to have too great influence. The quantity and quality of the fertilizers which have been applied, the character of the crops which have been grown, and the degree of cultivation which has been given, should be taken into the account.

This subject is of interest not only to men who are about buying land, but to every one who is both owner and manager of a farm. There are a great many farmers who have no accurate idea of the productive powers of their own farms. This does not, in all cases, indicate any special want of care or lack of observation. It takes a long time, and many experiments, to accurately determine the capacity of a farm. A field may do nicely when in grass, and the owner may consider it a splendid piece of land; but when he comes to plant corn, or sow oats, or barley, or wheat, he may find that for one, or all, of these crops

it is not at all adapted. A man may have a piece of land which he considers of no special value, but which may be well adapted to some crop which he has never grown. There are farms which have resources of which their owners have hardly dreamed. We do not refer to those upon which coal, or oil, or metals may be found, but shall confine our attention to the strictly agricultural products.

Whatever he may have done or neglected to do in the past, it will certainly pay the farmer well to carefully determine the productive capacity of his farm. He ought to know what crops he can grow to advantage and the quantity of each which he can produce. Even in New England, where the land has long been under cultivation, there are many farms which now produce but little, yet which are capable of becoming very productive. There is land which has been in grass so long that it produces but little, and the owner, having never seen anything else growing upon it, does not know whether a fair crop of grain can be obtained. Such fields should be plowed and tested. Cases have occurred where land which had been kept long in grass produced only very light crops, although repeatedly top-dressed, but which proved, when plowed and planted, to be some of the best land of the whole farm. If this process had been commenced sooner, the land would have produced at least twice as much grass, with no additional expense for fertilizers. It is sometimes the case that land will produce good crops of some kind of grain which the owner is confident will not grow thereon. In our native place there was a large tract of flat, and rather cold, land which from time immemorial had been used solely for pasture. It was owned by a large number of men whose farms ran directly across it. One farmer determined to plow a small piece and see if he could not obtain a crop of corn. His neighbors were confident that corn would not succeed in that location. But he plowed the land, applied a moderate quantity of manure, and put in the seed. The result was a great

success. The next year the experiment was repeated, and a good crop was secured. Other farmers tried the same plan and were successful. The land which was supposed to be very poor has now been growing corn, oats, and grass for thirty years, and is considered more valuable than some of the fields which were formerly thought to be far superior. The experiment of this farmer in planting land which was thought to be unsuited to cultivation, not only proved a great benefit to himself, but also opened a large tract of really good land for culture and gave many other farmers an opportunity to largely increase the profits of their business and add to the value of their farms. It is not to be expected that every experiment will result as favorably as this, but there are a great many farmers who might largely increase their crops if they would test the capacity of their land.

Too many farmers work after the manner of their fathers, and have an idea that because certain crops never were grown on their land, therefore the land is not at all suited to their production. But it is not at all certain that this will be the case. Because no wheat has ever been grown on a certain field, it does not necessarily follow that no wheat ever *can* be produced there. Neither does the fact that the farmers of former generations thought certain tracts of lands would not grow certain crops, prove anything upon the subject. Even if they had tried these crops and been unsuccessful, this would not be absolute proof that efforts now made in the same direction would result in failure. There have been certain climatic changes since their day which may exert a favorable influence. These changes have been, apparently, very slight, but they have been sufficient in some sections to considerably modify the results of cultivating certain crops. This modification may make it still more difficult to grow the doubtful crops, but there is an equal chance that it will prove beneficial. Again, the methods of cultivation now in use are much more perfect than those with which our predecessors were acquainted, and this difference alone may

make all the variation which will be necessary to turn utter failure into brilliant success. Another respect in which the farmers of the present day have an immense advantage over those of the past is to be found in the great improvement of varieties which has been secured. It is now easy to obtain much hardier and more productive varieties of wheat than any which our fathers ever saw. These varieties will grow, and ripen, and be very productive on land where the old kinds would not succeed. The same principle applies to corn and oats with equal force. Except in the case of crops which are wholly out of their sphere, and which from the very nature of the case cannot be grown, the only way in which to determine whether any particular crop will be successful in a certain field is to put the matter to a practical test. Actual trial is the only way in which there can be anything like a correct settlement of the question. This trial need not be made on a large scale. It is not necessary to plow the whole of a twenty-acre field in order to prove that the land can be plowed. And in testing the adaptation of any special crop to the soil, it is not best to do too much at once. A small area will determine the question as well as a large one. If the experiment is a success, the crop can be grown the next season on a larger scale. If it fails, a repetition should be made, as the failure may be wholly owing to local and unusual circumstances. But in no case should the first experiment with an untested and an uncertain crop be made on a large scale.

There are many farms which are specially adapted to the production of certain crops, but which are not valuable for ordinary farm purposes. The farmer who owns such land, and understands its capacities, is sometimes enabled to obtain very large returns. The cranberry lands of NEW JERSEY and MASSACHUSETTS were once considered almost worthless. But when the owners came to understand the capacity of these "bogs" and "flats," they found that they had some of the most pro-

ductive land in the country. There are other crops which are not adapted to general cultivation, but which will thrive in some peculiar soils and which can be made very profitable for the farmers who engage in their production. Not only should those who seem to have special privileges in this direction make careful experiments in order to determine the capacity of their farms, but those who have only the common soils, and grow only the ordinary crops, should not be contented with the present yield of their products unless they have proved that the limit of profitable production has already been reached. Many a man is cutting only a ton, or a ton and a half of hay per acre each year from land which might just as well produce two tons. Others are buying the breadstuffs for family use, while they have plenty of land on which they might grow good crops of wheat. Some who have followed the old system of farming have very little idea of the increase of crops which they might secure if they would, by the application of fertilizers, and by thorough cultivation, test the productive capacity of their land. We think that there is such a thing as crowding up the rate of production too high, but not one farmer in a thousand ever errs in this direction. The great majority are too well satisfied with a low yield. If they obtain a ton and a half of hay from an acre, they do not think of asking whether the same land might not be made, without much extra cost, to produce two tons. If they get fifty bushels of corn per acre, they do not ask whether the land is capable of yielding seventy-five bushels. Neither are they as careful as they should be to determine whether their land is best adapted to corn, or wheat, or some other crop. In short, they have not thoroughly tested their farms, and do not know the productive capacity of their land in regard to the quantity of the crops which they grow, and have not determined the important question from which of the crops they do or can produce they can obtain the largest percentage of profit. On this account many farmers are working at a great disadvantage.

They are very much in the dark concerning their business. They know that if a merchant made no effort to sell those classes of goods which pay a fair profit he could not succeed. They ought to see that it is just as important that they should obtain a profit on the crops which they produce. If they know just what crops will pay them the best, and then grow those crops to the best advantage, they will be very sure to obtain large returns; while if they are ignorant of the capacity of their farms, or neglect to obtain from their land all that they might and ought to secure, their business will not be profitable, and they will soon be complaining that "farming don't pay."

ANALYSIS OF SOILS.

TWENTY-FIVE years ago it was thought, by men who had made scientific agriculture a close study, that by means of an analysis the degree of fertility of any soil could be accurately determined. It was supposed that by this method the chemist could tell the farmer which crops would yield him the largest quantity per acre, which were best adapted to each particular field, and what kind and quantity of fertilizers would be needed to keep his land constantly productive. But when brought to the great test of practical application, there were found to be two objections to the plan. In the first place it was very expensive. Unless there were a reasonable degree of certainty that a great deal of practical and useful information could be obtained, the farmer could not afford to invest the amount of money which is required to make anything like a complete analysis of the soil in the different fields of his farm. But the second objection was still stronger than the first. Not only was it costly, but it was also just about useless. It did show the farmer the constituents of the soil, but it did not show him, what it was fully as important for him to know, what elements were in a condition in which

they could be assimilated by the crops. It had been supposed that if a soil contained large quantities of the elements of which the crops to be grown were composed, it would certainly be very productive. But in practice it was found that because a certain field contained large quantities of potash, or phosphoric acid, or lime, it did *not* follow that it would produce large crops. The chemist, with his powerful agents, can obtain from certain soils the elements of fertility in great abundance, while a large proportion of these elements exist in such a condition that the plants can make no possible use of them. For all present practical purposes these soils are barren, but if they were to be judged by the results of a chemical analysis, they would be considered extremely valuable. In order to be productive the soil must not only contain the materials of which plants are composed, but must have them well distributed throughout the surface of the land, and they must be in a condition in which they can readily be used by the crops. The mechanical condition of the soil has very much to do with its productiveness. Of this fact the chemical analysis makes no account. But in a practical point of view it is one of the determining forces which regulate the yield of the crops. If a soil is extremely hard, it is easy to see that the weak roots of plants cannot easily penetrate it. No matter how much plant-food it may contain, a very large proportion of it is locked up in the soil beyond the reach of the crops, and is, therefore, practically useless.

On the other hand, a soil may be quite deficient in the elements which plants require, and yet be so loose and open that the roots can reach every part of it and obtain all the food which there is. According to the chemist such a soil would be nearly worthless, but for practical purposes it would be more valuable than the other. Again, it has been often proved that a mixture of different soils, such as clay and sand, has produced much larger crops than either kind had grown before the change was made. Although the chemist would have said that the

clay was by far the most fertile, and it would naturally follow that an intermingling of a poorer kind of soil would instantly deteriorate its quality, yet the invariable effect of such an operation is a large and immediate increase of its productive power. From this it will be seen that, as far as a thorough analysis of the soil is concerned, the farmer has but very little to hope from the aid of the chemist. It must not be inferred, however, that the farmer is not indebted to the chemist, and that the great science of chemistry can throw no light upon the course which the farmer should pursue. Far from it. Chemistry cannot do everything, it is true. In some respects it has failed to do all which it was hoped would be accomplished by its aid. But in many respects it has proved an immense advantage to the farmer, and it is every day aiding him in his work. Even though the direct analysis proves imperfect, chemistry teaches the farmer how to test his soils so as to determine the character of the fertilizers which they require. It shows him the composition of the various plants which he cultivates, and the quantities of each of the fertilizing elements which an average crop abstracts from the soil. In many other ways it also proves a great help in the work of the farm.

That every farmer ought to know what elements of fertility his land contains in excess, and in what ones it is deficient, is so plain a truth that it needs only to be stated in order to be generally accepted. And because chemical analysis fails to give all the knowledge which is desired upon this subject, it by no means follows that this knowledge cannot be obtained. Not only is it not beyond the reach of the careful and intelligent farmer, but the results of chemical analyses make its attainment comparatively easy. Chemistry teaches us that plants take a large part of their constituents directly, or indirectly, from the air, and the remainder from the soil. Though there is a great difference in the quantity of materials, both classes are absolutely necessary for the growth and perfection of the plant.

Even if there were an unlimited amount of the atmospheric and organic elements within reach of the plants, they would not thrive if the supply of a single one of the mineral ingredients were deficient. There might be more nitrogen in the soil than ten crops could require, and all in a condition to be used, together with a large over-supply of most of the mineral elements, yet if there were a deficiency in any one of the constituents of the plant the growth would be imperfect, and large crops could not be produced. It is also impossible for an excess of one mineral to counterbalance the deficiency of another. Potash and phosphoric acid are both required in certain well-defined quantities, but one cannot take the place of the other, and too much of one will not in the least help a short supply of the other. Consequently, if any one of the principal elements of plant nutrition becomes exhausted, or so nearly exhausted that it cannot furnish an adequate supply, the crops will be small until this element is restored to the soil. The element to be supplied in any given case is not to be determined by an analysis, as was formerly supposed, but by careful experiment. Only a very few of the elements are at all likely to become exhausted. Of these the principal mineral ingredients are phosphoric acid and potash, while nitrogen is the only organic element which the farmer needs to supply. It is, therefore, very easy to test the requirements of a field. By applying nitrogen upon one plot, phosphoric acid upon another, and potash upon a third, and carefully noting the effect, the owner can very soon tell which of these materials the soil needs the most, and can form a very good estimate of the proportions in which they should be applied. In some cases the application of one of these elements will be sufficient, while in others all three may be required. This point can be readily settled by intelligent observation. The expense involved in making these experiments is very small. The publishers of the *American Agriculturist*, PROFESSOR ATWATER, of Connecticut, and the "MAPES FORMULA AND PERUVIAN GUANO

Co.," have made an arrangement whereby this question of the needs of the soil may be very easily answered.

The various fertilizers for supplying the different elements of plants are put up in small quantities, sufficient for one acre of land, which is to be divided into ten equal parts, and sold *at cost*. Full instructions for use accompany each sample which is sent out. To the farmer who has soils which are partially exhausted, this is one of the greatest aids which has ever been offered, and it can also be made very useful to those whose land is in good condition, and who wish to keep it constantly productive at as low cost as possible. Of course, the farmer can, if he prefers, select his own materials and try his experiments without either instruction or aid from others. He can obtain and use a supply of potash in the form of wood-ashes, he can obtain a quantity of fish-guano and thus supply his land with nitrogen, and he can buy a lot of bones and obtain phosphoric acid. But in the latter method there is much uncertainty, and though the application of any, or all, of these materials will be almost sure to be highly beneficial *some time*, it will not enable the farmer to determine either readily or accurately just what are the *present* requirements of his land. It is not an economical manner in which to conduct his experiments. Though very much better than nothing, it is very far from being the best method which he can pursue. He needs to know not merely what will make plants grow, but what particular elements of plant-food his soil needs at the present time. The results of general experiments will not prove sufficiently accurate to be a safe guide in future and more extensive operations.



PLANT LIFE AND GROWTH.

WHEN we approach the subject of plant life and growth, we come into the presence of a great mystery. We cast a small seed into the earth. For months, perhaps for years, that seed has been lying dormant. As far as mere appearance is concerned it seems as devoid of life as the stones in the field. But its dull and lifeless covering contains a germ which under certain favorable circumstances will be developed into a complete organism. The moisture of the earth causes the seed to swell, and, in a short time, a tiny stalk pushes itself toward the light and air, while a little root starts downward into the earth. The dormant seed has become a living thing, and, if no untoward event befalls it, will produce a plant which will ripen many seeds, each after its own kind, and each possessing the mysterious powers of life and reproduction. The development of the little seed into the larger plant, its growth, its ripening, and its provision for an unbroken succession of the plants of its kind, are, in themselves, simple operations, but they indicate the existence of a CREATOR, an INFINITE ONE, whose wisdom is utterly beyond our comprehension, and who is possessed of almighty power. We can see the various processes of growth, and we can facilitate or retard them if we choose. Man can stimulate the growth of the seed and can make the plant far more productive than it was in its natural state. By care in saving and storing them he can preserve the life of many kinds of seeds for a long period; but when, from any cause, the seed has lost its vitality, he can no more supply the life-giving principle than he can create a world. We know that under certain circumstances seeds which have not been injured will grow, and we also know that certain conditions, many of which we can control, are highly favorable to the rapid development of plants. Of the knowledge at our command we should make all the practical use which we possibly can, for, upon our attention to, or

neglect of, this, the question of success or failure in practical farm-life will very greatly depend. Leaving, then, with reverent awe the great mystery of life which is wrapped up, in some manner to us utterly incomprehensible, in every well developed seed, let us consider our subject in its purely practical bearings.

The vast majority of the plants with which the farmer has to do are grown from the seed. As already shown, after the seed has been deposited in the earth and has absorbed sufficient moisture, the growth of the plant begins in opposite directions. Figure 8 represents the germination of a kernel of Indian Corn.

Figure 9 shows the same plant after the first leaves have appeared. Within the seed there is stored a quantity of food to supply the wants of the plant until its roots are sufficiently developed to secure nourishment from the soil and its leaves are large enough to perform their respiratory and absorbent functions. From these facts the great importance of a suitable condition of the soil, and of placing the seed at the proper depth can be readily inferred. If the land in which the seed is planted is full of water, germination will be greatly retarded if not altogether prevented. For, while a certain degree of moisture is absolutely necessary to the growth of plants, too



FIG. 8.

much water will be utterly ruinous, as it will cause the seed to decay. The young plant possesses but little strength, and it is important that the soil in which it is to grow should be very fine, but not extremely compact. If the land is full of clods, and there is little or no fine earth, the roots cannot obtain a sufficient supply of nourishment to hasten the growth of the plants. Even though the soil may be very rich in plant-food, if its mechanical condition is such that the feeble roots cannot avail themselves of it, they are no better off than they would be in an utterly barren field. Many a farmer does not obtain anything like the crops which he might secure if he would only fit his land for the

reception of the seed in such a manner that, during the early part of their lives, the plants could easily obtain all the food which is necessary for their rapid growth.

Not only should the soil be pulverized, but it should be left loose and open enough to admit of the ready and easy passage of the roots of the plants. Otherwise, though the soil may be very rich, the plants cannot grow rapidly because the food which



FIG. 9.

is so near them is almost as unavailable as it would be if it were in a distant field. Roots cannot penetrate a stone, and they can make but little better progress in their efforts to enter some kinds of soil which have not been well worked. In many hard soils the roots of plants will attain considerable length if they can once get started; but will utterly fail if the surface soil is not made fine and mellow.

The depth to which the seed is planted often determines the question of its life and full development or its early destruction. If the seed is not covered sufficiently it will not obtain enough moisture to insure its growth. It may start, but if the moisture proves insufficient, its growth will be checked and the plant will die. If only covered deep enough to enable it to barely live, it is evident that the seed and plant must be placed at certain disadvantages, and be much more liable to injury by drought or accident than they would if it had been properly covered. Too deep covering is also ruinous because the supply of food stored in the seed will not be sufficient to carry the stem and leaves to the light and air, without which they must perish. This explains why large seeds require much

deeper covering than smaller ones, why very small seeds should be but slightly covered, and also proves a partial answer to the question why so many seeds which are planted fail to grow. With some seeds, like the sorgo, which germinate very slowly, and which, on this account, are liable to fail in unfavorable seasons, it pays the farmer to do what he can to hasten the process of germination. By soaking the seeds for a while, from twelve hours to three or four days according to the character of the seeds and the degree of difficulty with which they germinate, in tepid water, they will be more certain to grow, and the plants will come through the ground very much sooner than they otherwise would. When it is necessary to plant corn very late in the season, it is a good plan to soak the seed until the kernels are considerably swelled. It should then be rolled in plaster and may be planted with a machine if desired. When seeds have been kept so long that their vitality has become somewhat impaired, soaking in a weak solution of oxalic acid will cause them to germinate. In this way, if they have been well protected from moisture, very old seeds of some kinds of plants can be made to grow. But unless there is some special reason for making the attempt, it does not pay to even test these old seeds.

With but very few exceptions, new seeds furnish the best crops. When the seed is good, we do not think it often pays to soak it in order to hasten its germination. The only exceptions which we make in our practice are, when planting sorgo, planting over corn very late in the season, and, once in a great while, when in a hurry to get a few plants started in the garden or the flower-bed. Whenever we have reason to think that the seed which we have obtained for planting is not fresh and good, instead of soaking it we throw it away and buy a new lot. Time is too valuable, and labor too expensive, to make it profitable to run any risk on the quality of seeds. Good plants, if grown at all, will be grown from good seed. It is not

sufficient that the seed is not so old that it will not grow. It must not be so old as to have lost a particle of its vigor. There is a great deal of seed which will barely grow, but which will not produce vigorous plants. Such seeds should never be used.

After the plants have appeared above the ground, both roots and tops should grow with great rapidity. This rapid growth is essential. If it is not secured, the cultivator will not obtain a valuable crop. Whether the plants will grow in this manner or not, depends, in a great measure, upon the treatment which they receive. The manner in which they grow makes it certain that culture will be useful to plants of every description, and may be made a great aid in the production of farm-crops. The roots increase in length and throw out branches in all directions. While they are new and fresh, nearly all their surface is engaged in absorbing from the soil the moisture in which the plant-food is dissolved. By making the soil loose and open, the farmer can enable the roots to make a very rapid growth. The loosening of the soil also acts beneficially in time of drought, as it tends to condense the moisture of the air in the form of dew. When rain falls, the water can be used to much better advantage if the soil is light and open, than it can in a field in which the surface-soil is very compact. This loosening can be secured by the use of a cultivator, plow or horse-hoe. The same end can also be secured by following the method, in use in some parts of the South, of growing the crops on ridges of three or four furrows each, which are plowed just before planting time. As the roots increase in length, another furrow is occasionally plowed each side of the ridge. Thus, the roots are constantly supplied with fresh soil, which furnishes them with the food which it contains. If the end of a root is cut off, it does not continue growing in that direction, but sends out branches with many fibrous roots, which in a rich soil obtain large quantities of food, and thus hasten the growth and development of the plant. On this account root-pruning may

prove very useful, if performed when the plants are properly developed.

The stems form a connection between the tops and roots of plants, and thus furnish a mechanical support to the flowers and seeds. They also convey the nutriment, which the roots have secured from the soil and the leaves have obtained from the air, to all parts of the plant, thus providing for its symmetrical development. The leaves of plants are also vital organs. Through their leaves the plants secure the immeasurable benefits of the sunlight and air. They are the *lungs* of the plants, and their removal, when fully developed, will prove as destructive as the cutting away of the tops or roots. They inhale carbonic acid gas, and exhale water and oxygen. To quite an extent, nutritive gases are also absorbed by the leaves, and the vast quantities of surplus water, which are taken up by the roots, are evaporated by their aid. The number of pores in a single leaf is very large. On the under side of the apple tree leaf, there are twenty-four thousand of these pores for every square inch of surface. Through these pores respiration is constantly going on, and in the leaves the nutritive matter which the plant has secured is elaborated and fitted for the growth and development of the whole structure.

Plants are liable to certain diseases, and to be injured or destroyed by insects which prey upon them. As far as the disease of any one plant is in itself concerned, it is of but little consequence, and it would be time and money lost to attempt to effect a cure. One stalk of wheat, or one ear of corn, would not be missed from the smallest field; consequently, it is useless to attempt any cure of the individual plant. But when we reflect that a disease of one stalk may endanger every other stalk in the field, and that one insect will be almost sure to be very soon reinforced by thousands like itself, it becomes evident that the outbreak of a disease, or the appearance of insects, even on a small scale, or in limited numbers, is a very serious matter. The fungoid diseases, like rust and smut, with which wheat,

oats and other grains are so often attacked, and which prove so destructive to the crops, spread with great rapidity. The first appearance of either of these diseases may be in itself considered of little moment, but its results upon the crops for the next few years will be ruinous, if it is allowed to go on developing and multiplying itself. Here, as in a multitude of other cases, prevention is worth a great deal more than cure. The only reasonable hope of checking either of these diseases is by preventing their appearance in the next crop. When any particular crop is attacked, that crop cannot be cured. If the owner succeeds in stopping the trouble there, he will be very fortunate. But he must take stringent measures, or his crop for the next year will suffer much worse. If smut is the enemy, great care must be taken, not only that no badly affected grains are used for seed, but all the spores, which are the minute organs by which this disease is propagated, must be destroyed. In selecting seed-wheat from an affected field, it will not be enough to reject all the heads or kernels which are discolored. Every kernel which is to be sown should be immersed in very strong brine. Many of the lighter grains, and they are the ones which are most liable to be diseased, will rise to the top, and should be thrown away.

While in the brine, the grain should be stirred in order to separate all the poor grains which can be made to float. After remaining for about five minutes, it should be removed from the water and well covered with water-slaked lime. This lime should be thoroughly mixed with the grain in order to keep the kernels from sticking together, and also that the grain may gather as large a quantity of it as can be made to adhere. When rust is the disease with which the farmer is obliged to contend, the same care should be exercised in the selection of seed, and the soil should be supplied with the elements which will insure vigorous plant-growth. On some soils ashes will produce this result. Others need phosphoric acid, while on

some fields salt would prove a great help. It should always be remembered that weakness in a plant invites an attack from these fungoid diseases, and that the weaker the plant the greater the injury which an attack will produce.

The same principle applies to the injuries by insect depredations. If the land is poor, or is not suited to the crop, if the plants are feeble and make very slow growth, insects will be almost certain to make an attack, and, principally because the plants are so weak, do a great deal of damage. Although it reduces the crop from what it would be if no enemy appeared, yet even the Hessian fly will not prevent a good yield of wheat on land which is fitted for the crop, and which is abundantly supplied with all the elements of nutrition which the plants require. If the very best seed is selected, so that strong and rapidly growing plants will be produced, and these plants are constantly supplied with all the food they can use, and that food is in a condition in which they can use it as rapidly as wanted, the vigor of the plant will overcome the depressing influence of the insect foes. These insects will absorb the juices of the plant to quite an extent, but there will be enough left to mature a fine crop of grain.

Insect enemies are not the only ones with which plants are obliged to contend. There are plenty of supplanters in the form of weeds. These weeds are subject to the same laws of growth and development as cultivated plants. The main difference between them is to be found in the fact that our cultivated plants are useful to man, while the plants which are denominated weeds are useless. Being of the same nature, and subject to the same laws of growth, these are very formidable enemies. They can be destroyed, it is true, but a great deal of work is involved in the operation, and no wholesale methods can be adopted, because any plan of this description which would destroy the weeds would also ruin the crops. Therefore a careful selection must be made, and the weeds separated from the plants which are to

produce the crops. Not only does the similarity of their natures and methods of growth increase the difficulty of destroying the weeds when they appear among the crops, but it also renders their presence much more injurious than it otherwise would be. If they used an altogether different class of elements with which to perfect their growth, the weeds and the corn plants might grow side by side without greatly interfering with each other. But we find in practice that the weed takes the food which the corn ought to use, and that the farmer who thoroughly manures a good field can choose whether he will grow thirty bushels of corn and a heavy crop of weeds on an acre, or fifty bushels of corn without any weeds. There will not be plant-food enough to mature fifty bushels of corn *and* the weeds. It will be a rule to which the practical farmer will find no exceptions, that the more weeds he grows the less the quantity of the crops which he will obtain.

It is a peculiarity of plant-growth that without heavy and frequent manuring no class of plants can long be successfully grown upon, and removed from, the same piece of land. And as a general rule, to which there are a few exceptions, unless the fertilizers which are used are specially adapted to meet the wants of the particular crop, even high manuring will not insure perfect success in its long-continued cultivation upon the same field. Something in the line of a crop can be grown by planting corn on the same land for many years in succession, but unless the fertilizers are specially fitted to supply the demands of the corn crop, the yield will steadily decrease, and will soon fall below the limit of profitable cultivation. But if corn is followed by wheat, and the wheat by grass, and in a few years corn is planted again, there will be no such falling off in the yield. The explanation of this is to be found in the fact that while our cultivated plants are composed of very nearly the same substances, these substances are used in very different proportions by different crops. Some plants require large quan-

tities of potash and but little nitrogen for their perfect development, while others need a great deal of nitrogen and but little potash. On this account a change of crops not only insures a much larger yield than could otherwise be obtained, but it also prevents the rapid exhaustion of the soil.

All good soils contain the elements of plant-food in vast quantities. Chemistry has shown that the average American soil contains potash enough to supply the wants of a fair crop of cotton for more than twenty-five hundred successive years. But in practice the cotton-grower finds that he must regularly supply his soil with manures containing potash, or else be content to produce this crop only once in a term of years. If he attempts to grow cotton every year, without fertilizers containing quite a proportion of this element, he will miserably fail. But if he alternates cotton with corn, oats, and grass, so that this particular crop is grown only once in six or eight years, he will have much better success. This is explained by the fact that of the immense amount of potash in the soil, but a very small proportion is ever available at a time. A little can be taken this year, and if the land has rest, or crops which use but a small quantity of this element are grown, more can be taken in the future. By the action of the sun, and rain, and air, chemical and mechanical changes are constantly being made in the soil. Day by day the disintegrating process goes on. The land is absorbing nitrogen from the air, potash and phosphoric acid are being set free in the soil, and thus a supply of plant-food is constantly being provided by nature. A frequent change of crops draws more equally upon the supplies, which are thus made ready for the plants, prevents the rapid deterioration of the land which must otherwise result, and also secures a larger percentage of profit from their production than could be obtained if no change were effected.

While plants very closely follow the law that like produces like, it is still true that man is able to exert a very strong modi-

fyng influence upon them. By careful selection and skilful culture, plants can be bred as truly and as exactly as animals. Their time of reaching maturity can be hastened or delayed, their size can be largely increased or diminished, the form of their flowers can be changed, and they can be made much more prolific than they are in their natural state. The gardener and the florist make constant use of their powers in these directions, and the practical farmer often finds it beneficial to avail himself of the results of their efforts, and to supplement these with his own labors in the same field. The principal changes in the character of plants which farmers desire are those affecting their size, time of maturing, and their yield of valuable products. These changes are secured in various ways. When single specimens are wanted, as a dwarf maple or walnut, the Japanese method of severe root-pruning and frequent transplanting may be adopted. The union of different trees by grafting will sometimes accomplish this result. The dwarfing of the pear by grafting it upon the quince is a very common practice, and furnishes a good illustration of the principle under consideration. Garden plants may be dwarfed by frequently cutting the roots, or by occasional transplantings. By following this plan for several years, and carefully saving the seed of these plants, the dwarf habit will probably become fixed. But for practical purposes it is usually found better to increase rather than check the ordinary development of plants. By selecting the largest specimens which can be found for seed, planting them on rich land, using the very largest specimens which result from this planting for seed for the next crop, and continuing this course year after year, the size of almost any variety of grain can be largely increased. Rich land, high culture, and careful selection of seed, will be very certain to accomplish the desired result.

A change in the time in which any kind of grain will mature its seed can be effected in a somewhat similar manner. For, although plants are specially adapted to certain conditions, they

have considerable flexibility in adapting themselves to the circumstances in which they may be placed. A variety of corn, which in CANADA will ripen in ninety days from the time of planting, if taken to the MIDDLE STATES, will gradually grow larger and ripen later. Finding that it has much more time in which to mature, it will grow with reference to a longer season than the ones to which it had been accustomed. So rapid is this change that farmers in Southern MASSACHUSETTS, who want a variety of corn which will ripen early, frequently send to CANADA, or to Northern VERMONT for seed. The first year after planting, the corn ripens very early, sometimes as soon as the middle of August, but the second year it is later, and in a few seasons it becomes so thoroughly acclimated as to require as much time in which to mature as the ordinary varieties need. On the other hand, if corn is taken from a warm to a colder climate, if the change is not so great as to wholly prevent the ripening of the seed, a directly opposite change will take place. The corn will ripen earlier than it did in its Southern home, and thus adapt itself to surrounding circumstances. This is on the supposition that natural laws are allowed to have their full influence, and man makes no effort to check or change their workings. But by skilful management the tendency which has been noted can be fully controlled. If desirable, some progress can be made toward the other extreme. By selecting the ears of corn or heads of wheat, which ripen first, using them for seed, and from their crops obtaining the earliest specimens, and following this course several successive years, all tendency to ripen later in the season can be overcome, and a very early ripening variety be secured. By the opposite course in selecting seed the grain can be made to ripen much later than its natural time.

Other things being equal, those specimens of grain are the most valuable which are the most prolific. Consequently the skilful farmer makes an effort to increase the yield of his crops,

not merely by increasing the fertility of his land, or by sowing an excessive amount of seed in order to secure a very large number of plants, but by selecting the most prolific plants which he can find. These other methods have often been tried, but they are defective both in theory and in practical application. It is necessary to have the land in good condition, and to use a suitable quantity of seed in order to secure a good crop. But after reaching a limit which is not far beyond the general practice of the better class of farmers, an increase in the former direction does no good, while an increase in the latter works positive evil. The main hope of the farmer who is to improve the quality and increase the yield of his grain lies in the line of a careful and intelligent selection of the seed from which his crops are to be produced. The quality of yielding large crops can be made a permanent characteristic just as truly as that of early ripening. The seed from a very prolific plant will be likely to produce other prolific plants. The farmer who will take advantage of this characteristic of plant-growth will be able to do much toward making his business very successful.

In their natural state, and when left to follow out their own inclinations, the smaller plants seem to live and grow for the one end of reproduction. When they have matured their seed, and thus provided for a succession of their kind, they seem to have fulfilled their mission. Soon after this end has been secured, the plants perish and are succeeded by others. The larger class of plants, including trees, which require many years in which to mature, generally produce seed annually for many successive years. But the plants in which the farmer has the deepest interest are comparatively small in size and short-lived. Their reproductive functions are exercised the first or second year of their growth. They are divided into three classes: annuals, biennials and perennials. The former, of which corn, oats and beans are examples, grow from seed, produce flowers, and ripen their seed in a single season. There is no way by which they

can be kept alive more than one year. Biennials live only two years: beets, carrots and onions, are familiar examples of this class. In severely cold climates many biennials need protection during the winter, or they will be destroyed by the frost. During the first season these plants store up a large amount of nutritive matter in bulbs or roots, with the design that this material shall be used the next year to supply the wants of the plant during its exhausting efforts to mature its seed. The second season, if the plant reaches it unharmed, one or more seed-stalks are thrown up, flowers are produced, the seed forms and is ripened, and when the pod which contains it falls off, or by splitting open allows the seed to reach the soil, the plant dies. The bulb which grew the first year does not grow during the second season; and the stores of food which had been obtained and stored within it are exhausted in the processes of flowering and seeding. Theoretically, perennial plants are "ever living." But many of the plants which the farmer cultivates become weakened by age, so that it is found profitable to ignore, to some extent at least, their perennial nature. Some of our best grasses are perennial, but the hay crop can be largely increased by re-seeding the land every four or five years. The same is true of some other plants. Climate also has some effect upon this character of plants. This is illustrated by the cotton plant, which is an annual in this country, but a perennial in hot climates. Whatever the length of time which a plant has to live, it will follow a fixed order of growth and development. When it has attained a certain age, it will, if the surroundings are favorable, blossom, and from the flowers then put forth produce its seed. In some cases, as the apple, there is a fruit with the seed enclosed. In others, like the pea and bean, there is only the seed. The flowers of some plants are perfect, and provide for their own fertilization and the perfection of their seed. The apple-blossom furnishes a good illustration. Other plants produce different flowers which

are imperfect alone, but, if both are allowed to develop, are perfect together. The common corn is a fine specimen of this class of plants. The "tassel" is one flower; the "silk" the other. One fertilizes the other, and secures the production of seed. But neither one alone would be useful. If all the tassels were removed from a field of corn as soon as they were fairly out of their leaves, and there was no other corn in the vicinity, there might be a fine growth of stalks and plenty of cobs, but not a single kernel of corn would be produced in the whole field. The preservation of the "tassels" and removal of the "silk" would also secure the utter barrenness of the plants. Some varieties of the strawberry have imperfect flowers, and, though the plants may be very strong and look nicely, when planted by themselves they will produce but very little fruit. By setting a vigorous perfect variety in every third or fourth row, all the plants may be made fruitful. It will be seen that the flowers are very important organs, and are essential to the reproduction of the plant. If the blossoms are removed or destroyed, neither fruit nor seed can be obtained. If they are weak, or imperfect in any respect, the fruit and seeds both suffer in consequence. The essential organs to plant-reproduction are the stamens and pistils. Plants which are perfect have both, either in one flower, like the fertile varieties of the strawberry, or in two, like the corn plant. The stamens secrete a fine dust called pollen, which is received and absorbed by the pistils, which are fecundated thereby. The pollen is scattered upon the pistils by the winds and by insects, which in great numbers spend much of their time in going from flower to flower. The experiment of artificial fertilization has often been tried, but has seldom proved beneficial. Nature seems to have made ample provision for the preservation of the different varieties of plants.

In order to change the character of varieties, horticulturists sometimes resort to a process called hybridization. This is a

“crossing” of two varieties which belong to species which are very closely allied. These are the only kinds with which it can be effected. The method which is adopted is to remove all the stamens from the flower of one kind which is to be “crossed” before they have deposited their pollen, and dust the pistils with pollen from the other variety. This is done in the hope of combining the fine qualities of both kinds in a single plant. With fruits the qualities of hardiness and earliness possessed by one kind can sometimes be united with the fine flavor which distinguishes another, and thus a variety greatly superior to either of the parents can be established. It is a difficult matter to obtain any great degree of success in these efforts, but they are sometimes very well rewarded. ROGERS’ HYBRID grapes, some of which are very fine indeed, are examples of the successful result attending some experiments in this direction.

Lest some of our practical readers should feel that we have devoted too much space to describing how plants grow, and imagine that we have lost sight of our expressed intention to try to show how farming can be made not only a pleasant business, but also how it can be made to PAY, we will briefly allude to some of the points which have been brought out, and show that they have as thoroughly practical a bearing as any one can desire. Still, we think if this were omitted, and even if the processes of plant-growth had no particular bearings of a practical nature upon a farmer’s work, the space devoted to a consideration of this subject would be far from wasted. Knowledge is valuable, and its possession makes a man happier than he could be if he remained in ignorance. It gives him something about which to think. There are men so ignorant that they work very much like their horses and oxen. Such men are not usually successful in any sense of the term. The farmer spends a large part of his waking hours in the great laboratory of nature. He knows that plants grow, for he sees the operation going on all around him. But this should not be

enough. He ought to inquire *how* they grow, and by what means their progress can be increased. Especially should the boys who work on the land be made acquainted with the principles of plant life and growth. A little knowledge upon this subject would make their work seem lighter, and give them a taste for agricultural pursuits.

We have seen that the well-developed seed, which has not been injured, is possessed, in some mysterious manner, of the undeveloped powers of life and growth. Though man cannot impart vitality to a seed which has lost its power of germination, he can do much to insure the prompt germination of good seeds, and hasten the growth of the plants produced therefrom. The fact that in the first stages of development plants are very weak, should lead the farmer to carefully prepare his land for the reception of the seed. For if the land is not in good condition, the plants will not be able to obtain nourishment enough to give them a vigorous start, and on account of this deficiency in the early and critical stage of their growth, they will always be weak, and will be comparatively unproductive.

As the plant is sustained upon the nourishment which is stored up in the seed until its roots are sufficiently developed to obtain food from the soil, and its leaves reach the light and air, it is a matter of great importance that the seed shall not be planted too deeply; while the fact that a certain degree of moisture is necessary to insure the rapid germination of the seeds, and hasten the growth of the plants, makes it evident that covering to a proper depth is essential. As an excess of moisture utterly destroys the seed, the benefit of draining land that is excessively wet is apparent. Because seeds must have moisture before they can grow, it does not follow that they should be planted in the water or in a water-soaked soil. The knowledge that germination can be hastened places within reach of the farmer the power to insure the growth of certain crops, which if planted after the ordinary manner are very likely

to fail. It also enables him, when obliged to plant late in the season, to obviate some of the difficulties in which he would otherwise be involved.

A knowledge of the way in which plants grow shows the farmer the great benefits which result from a frequent and thorough cultivation of the land. By loosening the soil around the plants he enables the air to penetrate it to a greater depth, thus insuring its rapid absorption of the fertilizing gases of the atmosphere. He also aids and hastens the disintegrating process which nature is constantly carrying on, and by means of which the elements of fertility which are locked up in the soil are made available. Frequent stirring of the soil makes its particles fine, allows them to be easily dissolved by rains and dews, and thus sets free the plant-food which they contain. And if the ground is kept loose and open, the roots of the crops can readily penetrate it in search of food, and thus a rapid growth of the plants can be secured.

By knowing something of the methods of plant-growth, the farmer is able to labor intelligently to destroy the insects and prevent the diseases which prey upon his crops. Ignorant effort would avail but little. But the farmer who knows that it is possible to feed his plants so well that there will be sufficient food for plants and insects *both*, can easily avoid most of the evil effects of their depredations. The farmer who is wise enough to soak the seed of his grain crops in something which will destroy the germs of disease, will thus prevent a great loss, and be far more successful than one who thinks but little and reads less. The farmer who knows that the weeds which grow in cultivated crops are sustained by plant-food which the crops ought to have will labor more intelligently, and with greater perseverance to destroy them than one who regards them merely as obstacles to the easy harvesting of his crops.

The man who knows that corn and potatoes take the various elements of plant-food from the soil in very different proportions

will not commit the mistake of growing either crop on the same land year after year, but will alternate these and other crops, and will thus prevent the exhaustion of any of the elements from the soil. In his change of crops he will labor intelligently, and if he is a careful reader, he can very accurately adapt his crops to the condition of his land and the quality of the fertilizers which he is able to apply. His knowledge of the methods of plant-growth will take his work out of the realm of chance. He will not be obliged to "guess," but can be able to know what crops to raise and how to grow them profitably.

The fact that knowledge concerning this department of his business will enable the farmer to modify the size of his plants, vary their time of ripening, and make them more prolific, is abundant proof that the information given about the methods of plant-growth is not merely theoretical, but is thoroughly practical. While it may confer pleasure and satisfy curiosity, it also yields great practical benefits.

A knowledge of the method in which the reproductive process of plants is carried on places within reach of the farmer, who has time and patience for the work, the means of greatly increasing the value and productiveness of his crops. It is this knowledge worked out into practical experience which has given the farmers of this country their best varieties of grain, their finest fruits, and the improved potatoes which are now so commonly grown. It enables the farmer who does not feel able to obtain new varieties to select seed in the best possible manner from those which he already has, and to rapidly improve both their yield and quality.

Instead of being merely theoretical, and calculated only to gratify curiosity, knowledge upon the subject of plant life and growth is of immense advantage to the practical man who will use it aright, and it ought to be secured by every one who tills the soil.

FERTILIZERS.

WE have endeavored to show that plant-growth is not a creation, but a gradual formation, by certain well-defined processes, of plants out of substances which are contained in the soil and air. While man is utterly powerless to give life to a seed which has lost its vitality, or to restore to vigorous growth a plant that is dead, it is possible for him to do much to promote the growth and increase the yield of plants which are alive. Some of the methods by which he can accomplish this result have been already alluded to, but their importance demands a much more careful consideration. It is not enough to know that plants obtain food from the soil, though this knowledge is valuable and may be made the base for effective action. Neither is it enough to be acquainted with the methods of plant-growth. We must go farther, and make our knowledge available for practical use. Several of the peculiarities of plants are of sufficient importance to warrant a careful consideration by themselves. Of these, the kinds of food which are required, and the method of obtaining it, are among the most prominent. It is a matter in which every farmer is deeply interested in a pecuniary point of view, and of which he ought also to obtain all the knowledge in his power. Let us examine this subject in connection with the fertilization of the soil.

Plants need food just as truly as animals, and will just as surely perish if no food is supplied. This food is obtained from two sources: the soil and the atmosphere. Although not taken in equal proportions, the elements from each source are, as far as the plant is concerned, of equal value. No excess in the amount of food from one source can atone for a deficiency from the other. The organic and inorganic are both absolute necessities. Of the former, about ninety-five parts in every one hundred are required. Of the latter, only the remaining five

one-hundredths. The organic elements can be destroyed by fire, and under the influence of a high degree of heat will disappear in the form of invisible gases. The inorganic elements were improperly named, for they are as essential to the organization of the plant as the organic. When a plant is burned, these inorganic elements remain in the form of ash. Though only a very small part of the plant, this is all the substance which it derived directly from the land. It has been estimated, however, that on account of the existence of all the atmospheric elements in the soil, plants really derive about one-half of their material from the earth. The organic elements of which plants make use are four in number: oxygen, hydrogen, carbon and nitrogen. Of these all except nitrogen are furnished in sufficient quantities by nature, and this is also supplied to some extent. As we shall have occasion to refer to this element many times, it may be well to say that it is always obliged to undergo a chemical change before it can be used as food for plants. Uniting with oxygen it forms nitric acid, while in union with hydrogen it forms ammonia. Both of these are powerful fertilizers, but it is in the latter form that nearly all of the nitrogen which plants use is made available. Consequently, nitrogen and ammonia are often used as interchangeable terms. When ammonia is spoken of, it always indicates nitrogen in a condition immediately available for plant-food; but nitrogen may be what its name implies, and yet be in such a form that it cannot be used for a long time. Some authorities consider the nitrogen in organic matter worth only three-fifths as much as actual ammonia. This point should always be kept in mind when the relative value of fertilizers is under consideration. Otherwise serious mistakes will be made.

The inorganic elements, though forming such a small proportion of the substance of the plant, are eight or ten in number. But with several of these the farmer has but little to do, as there is a great abundance in all soils, and he never needs to supply

them. As far as plant-food in itself is considered, there is not often a necessity for applying soda, or sulphuric acid, and except in occasional instances, or for special crops, there is no call for the use of magnesia. In large sections of the country there is no need of applying lime for the purpose designated. The elements which are in almost universal requisition, which are needed almost everywhere and almost always, and the only ones for which there is anything like a general demand, are phosphoric acid and potash. With this knowledge of the materials of which they are composed, it seems as if it would be very easy to insure the rapid growth and perfect development of plants. It is reasonable to suppose that if man will supply an abundance of the raw materials, nature will elaborate them and convert them into living structures. Practical experiments continued through many successive years prove that this is as true in practice as it is evident in theory. If man furnishes the proper materials in sufficient quantity and in a suitable condition for use, and will take good care of his plants, he will be amply rewarded by a bountiful crop.

It is now in order to consider the SOURCES OF SUPPLY of these elements of which plants are composed. These are several in number, and diverse in character. Of some of these materials the ATMOSPHERE furnishes an inexhaustible supply. These are distributed everywhere. Man can neither increase nor diminish the supply, and there is not the slightest need of his making the attempt. It is wonderfully compounded, and is perfect in its action and its effects. Whether the soil is rich or poor, whether the plants are well supplied with mineral elements, or are starved for want of them, there will be no scarcity of the atmospheric materials which are required for their growth. Still, it is possible for man to cut himself off from the benefits so liberally bestowed. If he grows his plants in such dense masses that the air cannot obtain access to them, they will not thrive as they ought. The sunlight and air are

absolutely necessary to the securing of rapid and healthful plant-growth. It is utterly useless to attempt to grow plants without them. For, though there are materials enough in the air to supply all the elements in rich abundance which ever come from that source, there must, of necessity, be room for the circulation of the air, the admission of the sunshine, and space enough between the plants to allow the rapid evaporation of water which may fall in heavy showers or long-continued storms. If he will simply give 'room enough to allow the fulfillment of these conditions, the farmer may rest assured that all the oxygen, hydrogen, and carbon, which his plants require, will be furnished free of cost. Of the remaining organic element, nitrogen, the atmosphere also furnishes a considerable quantity, but not enough to supply the needs of plants. Some of these elements are used in the form of water, others are inhaled by the leaves, while the remainder pass from the air to the soil before being used by plants. WATER may also be considered as one of the sources of supply of food for plants. As plants receive their food from the soil in a liquid, soluble form, and cannot make use of it in any other way, it is evident that water plays an important part in plant life and growth. It is composed of oxygen and hydrogen, and furnishes both of these elements to the plant. It brings down, when falling as rain, nitrogen from the air, and also absorbs it during dry weather. Many plants are very largely composed of water, and could not flourish without large quantities were constantly supplied. The cabbage plant is nearly nine-tenths water, and potato-tubers owe three-quarters of their weight to the same material. Other plants use much smaller proportions, but cannot grow without some water is supplied. As water serves the triple purpose of supplying plant-food in its own constituents, absorbing it from the air, and acting as a vehicle for carrying to the plant the food already contained in the soil, it can be readily seen that the success of the farmer will be largely influenced by the water-

supply of his plants. The regulation of this supply is also a matter of great importance, and will be considered in due time.

The sources from which plant-food are obtained which have been already considered are subject to the control of man in only a small degree, and many of the elements which are thus provided are furnished in such abundance as to need no effort on the part of the farmer to increase the quantity which nature bestows. It now remains for us to consider the SOIL as not only an important, but, as far as man is concerned, by far the most important of any of the sources from which food for plants can be obtained. A large part of his labor is devoted to its cultivation, and to the soil he adds the fertilizing elements which he uses to increase the growth of his crops. In itself the soil is a great storehouse of plant-food, and it is constantly absorbing valuable elements from the air, and securing them from the decomposition of vegetable and animal substances in and upon the land. The supply of plant-food is not uniform in all soils, but in those which have not been injured by the removal of successive crops without an adequate return of fertilizing materials, or which, on account of some peculiar local causes, are barren, there is a large quantity of materials which are capable of being converted into plant-food. If we consider their formation, we shall find that soils have within themselves a wonderful recuperative power, and that those which have been exhausted can again be made fertile by means of the changes which are wrought by time. It will also be evident that all soils now in good condition can be easily kept up to their present state of fertility.

It is supposed, and this theory does not conflict with a reverent acceptance of the BIBLE, that the land which is now capable of being cultivated was once solid rock, and that ages ago, long before man was created upon the earth, this rock was ground, and scratched, and scoured, by vast fields of ice which in the form of glaciers flowed over the continents; that by the

means of terrific storms, by the alternations of cold and heat, and the various chemical and mechanical changes which were thus effected, the rock was fitted for the production of certain plants of a low order. These sprung up, matured, and decayed. Others succeeded them in the same course. When sufficient organic matter had been formed, a higher class of plants appeared. These in turn absorbed from the air vast quantities of those elements of plant-food which it is its office to supply, drew from the earth the mineral elements necessary for their perfection, and in due time perished, leaving all their rich accumulations of plant-food in and upon the soil. Meanwhile climatic changes had been going on, and the earth was being fitted for man. During these ages the soil was not only fitted to produce the plants which are useful to men, and which now cover the earth, but vast quantities of carbon were taken from the air by the dense vegetation which at some periods covered the world, and were stored up for the use of men and plants in the future. The great beds of coal which are found in various parts of the world are stores of carbon which were gathered by plants in the olden time. This coal not only proves of immense value for fuel, but when it is burned it sets free a large quantity of carbonic acid which goes into the atmosphere and furnishes food for the support of plant-life. Thus even the coal, which the farmer would naturally suppose could be of no benefit to him except to keep him warm, becomes an active agent for supplying his plants with one of the elements of their food which they need in large quantities. The rocks which had been pulverized furnished mineral food for plants, the decay of vast masses of vegetation supplied carbon and ammonia, and the air and water furnished oxygen and hydrogen in great abundance. In this way the world was slowly adapted to become the abode of man, and to produce those plants and fruits which are necessary to promote his comfort and happiness.

Soils vary greatly in color and in some of their other

characteristics. This difference is caused by the different nature of the rocks of which they were composed. The sandstone, granite, and limestone rocks have been converted into different colored soil, but this color, while showing the origin of the soil, does not furnish an index to its fertility. In addition to the soils which were formed from the underlying rocks there are, in many localities, tracts of land the surfaces of which have been formed wholly by deposit. These are usually very productive. Where they are still subjected to an annual overflow of rivers and deposit of the impurities of the water, they produce good crops without manure and retain their fertility. But ordinary soils cannot endure this treatment without injury. They will produce crops which, if allowed to decay where they grow, will make the land more fertile, as they will return not only all which they have taken from the soil, but also all the organic materials which they secured from the atmosphere. But when man removes a crop, he thereby takes from the soil all the mineral elements contained in what he secures. If he returns nothing, his soil grows poorer and poorer with the growth of every crop, and in time will become unproductive. Some soils become deficient in one ingredient while having plenty of the other elements which are needed, while from others a different element is first exhausted. Therefore it is necessary to know something of the formation of an exhausted soil, and the cropping which it has received, before it will be plain what particular fertilizers to apply.

In some measure the soil can be made self-fertilizing. The rocks of which our soils have been made contained the mineral elements of plant-food. By the grinding, and pulverizing, and chemical changes through which they have passed, these rocks have been fitted for the sustenance of crops. But this has been done in a very gradual manner, and in this way the process is still going on. Only a very slight proportion of the soil is yet fitted for plant-food. The weight of an ordinary soil on one acre of land, calling it six inches deep, is about six hundred

tons. The weight of inorganic matter removed from the soil in a large crop of wheat, say thirty bushels of grain and thirty-six hundred pounds of straw, is only two hundred and fifty-two pounds. Yet there are very few soils which have been long under cultivation which will produce thirty bushels of wheat per acre without manure. And the failure to produce large crops of wheat is frequently owing solely to a deficiency of the inorganic elements in the soil. The quantity of grain and straw required for a good crop could not be grown, because in a whole acre of land there was not two hundred and fifty-two pounds of the inorganic materials, which would have been needed to produce this yield, in a form in which they could be appropriated by the crop. There are soils on which wheat does not yield well, because they are deficient in organic matter. Yet thirty bushels of wheat and thirty-six hundred pounds of straw would require, in a soluble form and properly distributed, only about sixty-two and a quarter pounds of organic material, in addition to that which is freely supplied by water and the air. In such a case the failure results from the want of this very slight quantity of plant-food, in a condition in which it can be used, in a whole acre of land. By means of the decay of plants, and the death of worms and insects, together with absorption by the soil, the land is being constantly replenished with organic materials, while the chemical and mechanical changes constantly going on slowly, but surely, add to the stock of mineral elements which plants require. The gradual decomposition of the soil is a wise provision for preventing its waste by the carelessness of man, and keeping a constant supply of food ready for each generation of plants as its needs may require. The soil is really inexhaustible as far as its mineral elements are concerned. It may be badly used—so badly that only very small crops can be grown—but there will still remain vast quantities of plant-food waiting the proper time for their change. To some extent man can hasten the process which nature is constantly carrying on.

He cannot do this so rapidly as to involve a great waste of these elements, but he can secure all that the largest crops which can be grown will require. The method is simple, and consists in merely following, on a smaller scale, the processes which nature has so long carried on. Pulverizing the soil will certainly unlock stores of plant-food which otherwise had remained unavailable. By taking a peck of soil from a common field which has been long under cultivation, drying and sifting it, it will be found that much the larger part will remain in the form of fragments of rocks, gravel, and hard lumps of earth, which will not pass a fine sieve. It is only the very fine particles which are in any condition to yield the plant-food which they contain. Consequently, only a small proportion of the soil has its plant-food in an available form. But the fragments of rocks, the pebbles, the gravel, and the lumps of earth, all contain some of the elements which plants require, and will surrender them just as soon as they are pulverized and rendered soluble. This pulverization must be largely done by nature, but man can hasten the work. By using the plow, harrow, clod-crusher, cultivator and hoe, he can break up the lumps of earth and so open the soil that the carbonic acid from the air can fix "its corrosive teeth" in the atoms of granite, and limestone, and other rocks, and break them in pieces for the use of plants. Mechanical and chemical changes are constantly going on, but the more the soil is stirred, and the freer the access which the air can have, the more rapid will be their progress. So much can this process be hastened that some farmers have insisted that frequent culture was fully equivalent to manure, and that if the land could have an occasional rest and be thoroughly cultivated, it would produce good crops without the addition of foreign substances. We do not favor this extreme view, but there can be no reasonable doubt of the truth of the supposition that the chemical changes which are constantly going on in the soil are continually setting free some of the elements of plant-food,

and that this result may be greatly facilitated and increased by cultivation.

On many farms the SUBSOIL is also capable of furnishing a supply of plant-food. Many farmers have an idea that this is a wholly inert substance, and good for nothing except to furnish a foundation upon which the surface soil can rest. They have very carefully avoided plowing it, as they thought its admixture would certainly weaken the land which they were in the habit of cultivating. Others have tried the experiment of throwing up some of the subsoil, and have not been pleased with the result. Their crops have not been increased. In some cases they have been very perceptibly diminished. These men have no faith in mixing the subsoil with the surface, and do not believe that it will furnish plant-food if loosened and left where it is.

Still another class of farmers have tried the plan, and are pleased with the results which were obtained. Some plowed up the subsoil, thus exposing it to the influences of the light and air, while others merely loosened it without changing its relative position. The different effects which have been obtained as the result of practical experiment can be traced to various causes. Prominent among these may be named the fact that the subsoil in some localities is very different from that of other sections. While that of one field may be rich in the elements which plants need, that of another may be very deficient or may contain things which will be positively injurious. Again, some soils need an admixture of their subsoils to make them more retentive of moisture, more compact, or to produce other mechanical changes in their texture. There are also some fields in which a loosening of the subsoil proves very advantageous in the removal of surplus water. On the other hand, there are fields which are in a much better mechanical condition than they would be if their subsoils were mixed with their surfaces, and others in which a compact subsoil is of very great advantage in preventing the

leaching of manure beyond the reach of the roots of plants. Consequently, it is not at all certain that subsoiling will benefit any and every field which the farmer owns. It may benefit one and injure another. As far as supplying plant-food is concerned, it seems as if it might be of great benefit. The subsoil, as a general thing, is composed of the same rocks as the surface soil, and should be rich in mineral elements. It is almost certain that the injury which some farmers have thought resulted from mixing the subsoil with that above it was caused by the use of too large a quantity at a time. When first plowed up, the materials of the subsoil are in a crude state. They need to be warmed by the sun and be chemically acted upon by the light and air before they are fitted for supplying the wants of plants. If a large quantity of these crude materials is thrown upon the soil at once, a thorough mixture is utterly impossible and temporary evil will almost certainly result. In some cases, where the quantity of subsoil thrown up did not seem excessive, a very perceptible diminution of the crops has resulted for several successive years, while in others a marked improvement in the yield was noticed the first season and seems to have become permanent. It is certain that the subsoil is one of the sources of supply of plant-food, but there are difficulties and disadvantages connected with its use which in some localities, and under some circumstances, make it practically unavailable. Unless the character of the soil is such that common sense will readily show that such an effort will be utterly wasted, practical experiment must determine whether subsoiling can be made to pay in any particular field.

These great natural sources for the supply of food for plants—the atmosphere, water, soil, and subsoil—are sufficient to cause a luxuriant growth on nearly all the land which is so situated as to be adapted to cultivation. Under the undisturbed reign of nature the products of the land would neither decrease in quantity nor be impaired in quality. There would be no

"running out." The process of disintegration which is constantly going on in the soil would furnish the mineral elements as fast as they would be required, while the air and the decay of plants in the soil would supply plenty of the organic materials. But in his effort to secure large crops, and to grow plants on soils which are not their natural homes, man destroys this equilibrium. Instead of allowing the vegetable products of the land to decay thereon and return to the soil all the mineral elements which they had abstracted, and increase its stores of organic matter by the addition of that which in their growth they had secured from the air, man carries off a large proportion of the plants which are produced. In this way he removes, with every crop, both organic and inorganic materials. The disintegrating processes of nature are not carried on rapidly enough to supply this waste, and, if he makes no return, the farmer will find his land steadily growing poorer with each crop which he removes. Consequently, he must seek other sources of supply than those which nature provides if he wishes to grow good crops and keep his land uninjured.

We have found that all the organic elements except nitrogen will be supplied by the atmosphere, water, and the soil, and that many of the mineral elements exist in such abundance in the land that it is very seldom that the farmer needs to supply them. But there will usually be a deficiency in the soils which have long been under cultivation of both phosphoric acid and potash. These three elements, nitrogen, phosphoric acid, and potash, the farmer who is to manage his business either intelligently or profitably must supply. For certain crops he may occasionally need to furnish some of the other elements which plants need, and he may also find it profitable to use some of them for another purpose than that of directly furnishing plant-food from their own substance. Where shall he obtain the materials which he needs in addition to the quantity furnished by the natural agencies which have been considered? This is a very important

question to the farmer, and one with which the profits of his business are intimately connected. It is of no consequence to the plants where the materials come from or what they cost. If they are only in a condition to be used, the plants will take them without regard to their original character. It makes no difference with the plants whether the nitrogen which they receive is furnished by barn-yard manure or by Peruvian guano; but it may make a great difference with the profit of a crop whether the farmer uses manure which was made on his own farm or is obliged to pay a high price in money for the food which the plants require. The only thing with which the plant is concerned is that the food shall be furnished in an available form. With the farmer there is the added consideration of the cost which will be involved.

There are sources of supply which are altogether too expensive to be drawn upon by the practical farmer. These we have neither time nor space to notice, but will devote our efforts to a consideration of those sources from which either the great majority of farmers can obtain sufficient food for their plants, or which, at least, large classes will find useful for this purpose. It must not be forgotten that the circumstances of farmers in different parts of the country are very diverse, and that, on this account, materials which the increased crop will well repay one farmer to purchase may be altogether too expensive for another. If other things are equal, or nearly so, the farmer who can obtain a dollar a bushel for his corn can afford to pay much higher prices for plant-food than one who is obliged to sell for twenty cents a bushel. The man who has a ready and convenient market, and can sell for high prices all the crops which he can raise, can use materials which a man in opposite circumstances can in nowise afford to buy. The man who is obliged to sell his crops for a low price must grow them at very small expense for fertilizers, or he will lose money by the operation. He must not only secure something which will

make plants grow, but he must also obtain it cheap. Neglect of this very evident principle has involved many a farmer in loss. Too many men have taken it for granted that if a certain fertilizer would make crops grow, it must be a good one for them to obtain. Against this error it will be well to guard.

We shall not be obliged to go very far back in the history of agriculture to find a time when almost the sole reliance of the farmer for fertilizers was placed on ANIMAL EXCREMENT. The barn-yard, pig-sty and sheep-fold, were the places where the plant-food used upon the farms was accumulated. Here it remained until it was wanted for use, and it was not diluted by the admixture of any foreign substances. Neither composting nor the importation of concentrated fertilizers had to any extent been attempted. These old sources of supply have not gone out of date, but they have been largely supplemented by the use of materials which our forefathers either considered worthless, or else knew nothing about. Men of the present day have learned how to grow crops without the use of materials which our predecessors called manure, but they have not rendered these materials worthless, nor shown us how to farm to the best advantage without them. We need all the fertilizers which can be made on the farm, and can often profitably avail ourselves of some outside sources of supply. Everything in the form of manure should be carefully saved. A waste of manure, either in point of quantity or quality, is fully equivalent to a waste of money. For the money which the farmer receives is obtained from his crops, and the quantity, quality and value of the crops will depend largely upon the liberality with which they are manured. If the manure is carefully saved and used, large and profitable crops may be obtained; while if it is wasted, the crops must be small and will fail to pay a fair profit.

There are two principal ways in which a great deal of manure is wasted by those who design to be careful farmers. These are by undue exposure to the weather, and by uncontrolled fermen-

tation. It is not as common now as it was a few years ago to see the manure which cows have dropped in the stable thrown into piles in the open barn-yard, often directly under the eaves, where the sunshine evaporates a large part of the nitrogeous elements, while by the heavy and frequent rains to which it is thus exposed the inorganic materials are, to a considerable extent, leached out and lost. This was the old and almost universal method of neglecting the stable-manure, but the better class of farmers at the present day provide cellars under the stables, or sheds outside of them, in which the manure is fully protected from both sunshine and storms. Something of this nature ought always to be provided. Otherwise the best part of the manure will be lost to the crops, and all the labor of carting and applying it will be done at a great disadvantage. It costs the farmer just as much to apply a load of manure from which the best elements of plant-food have been evaporated and leached, as it does an equal quantity which has not been injured. But the results of the labor in one case will be nearly, sometimes quite, double what they will in the other. Injury by excessive fermentation sometimes takes place in the compost heat, but more frequently because nothing of this kind is provided. The horse-manure is specially liable to injury from this cause, and often becomes so "burned" as to lose half of its value. To prevent this great waste, the frequent application of water to the heap will be useful. A better way is to mix the horse-manure, which is very heating, with an equal quantity of cow-manure, which heats very slowly. This should be done every day when the stables are cleaned, and will prevent undue fermentation of the mass. If for any reason this process is impracticable, or it is desired to keep the horse or the cow-manure separate, a frequent treading of the pile will convert it into a solid mass, and almost wholly prevent injury from burning.

Not only are the solid excrements of animals of great value for supplying food for plants, but the liquid portion is also very

useful. The urine of the horse is more valuable than the solid manure. That of the cow is much inferior to her solid excrements, but is still very beneficial to plants. The urine from an ordinary cow in one year will weigh about two thousand pounds, and is considered worth nearly three dollars. This is quite an item among the various products of the cow, and, like all other liquid manures, ought to be carefully saved. Yet on a great many farms, even in New England, where economy is considered a great virtue, and where the facilities for saving urine are much greater than they are either at the West or South, this valuable material is almost wholly wasted. We know of farms which are managed by very economical men—men who are too “saving” to take an agricultural paper, or buy an agricultural book—who do not make the slightest effort to utilize the liquid manure made in their stables and yards. After their grain has been harvested, they carefully rake the fields in order to obtain the small number of heads which were scattered, and thus save a trifle which would otherwise be wasted; but they allow the most valuable part of the manure of their horses, and much of the fertilizing material which they might obtain from their cows, to run to waste without an effort to retain and make it useful. Even some of the most intelligent farmers, men who read and study papers and books which treat of their special business, do but little to save the liquid manure, which ought to enrich their land, and feed their crops. Their neglect is not due to ignorance or to carelessness, but is caused by a failure to see how the waste can be easily prevented. The plans, proposed by some writers, of having troughs, and tanks, and pumps, seem so complicated, and involve so much labor, that the average farmers think they cannot afford the expense. While something of this kind may be very desirable for large stock-farms, we think it possible for a man who only keeps a few cattle and horses to follow a more economical method, by which equally good results may be secured. If a

sufficient quantity of dry earth is used for "bedding," and a little plaster is added at proper times, nearly all of the manure, both solid and liquid, can be saved, and can be retained for an indefinite length of time without injury. In carrying out this plan, considerable labor is involved, but the results will amply justify its expenditure. The best material, all things considered, for this purpose is muck or peat. This should be dug from its bed, and exposed to the air for several months before being used. This is necessary, because in its crude state it contains a large proportion of water, and various acids which render it unfit for use in stables. The process of decomposition can be hastened considerably, and the water can also be evaporated more rapidly, if the pile is shoveled over every few weeks. If time and labor for this purpose cannot be spared, the muck may be treated with lime. The lime should be slacked with water, and three or four bushels (the measure before slacking) evenly mixed with a cord of muck. The addition of a bushel of salt to the lime is said to be very beneficial. This should be dissolved in the water in which the lime is slacked. If lime cannot be obtained, fifteen or twenty bushels of unleached wood-ashes may be used in its stead. This preparatory process should never be neglected, for, until the water with which muck is filled, and the acids which are always present in vegetable deposits which lie in their original beds, and which are only partially decomposed, are disposed of, the material is totally unfit for use. The water must be evaporated, and the acid condition must be corrected. The former can be done by exposure to the air, and shelter from rains, while the latter requires either considerable time, or the aid of lime or ashes as suggested above. Having prepared the muck, the next thing to be attended to is to store it in a convenient shed or stable from which it can be taken when wanted. If the material is thoroughly dry, only a small quantity per day will be needed to absorb the liquid manure of each animal.

In order to utilize what might otherwise be waste products on the farm, and also to increase the quantity and value of the fertilizer, broken straw, coarse hay, and corn-butts, should be used in connection with the muck. These materials should be run through a feed-cutter before they are spread on the stable-floor. This to hasten decomposition, increase their action as absorbents, and make it easier to load and unload the manure. A small quantity of the muck and a little of the strawy material should be scattered upon the stable-floors before the cows are let in at night. Early in the morning the manure and litter should either be thrown out upon the pile, or else a light sprinkling of muck should be thrown over it. When the cows are turned out, the stables should be cleaned, and care should be taken to mix the muck, manure, and straw, as thoroughly as possible. We greatly prefer this to the method which some farmers have adopted, of cleaning the stables only at long intervals, and keeping the animals clean by the daily use of considerable quantities of bedding. But in no case should the manure be thrown into an open yard where the sun will shine upon it, and the rain from the eaves, as well as what would naturally fall upon it, leach out its most valuable inorganic elements. If there is no cellar in which to store it, a shed for the protection of the manure will pay for itself in a very short time.

In addition to the materials already mentioned for common use, plaster can be advantageously employed. A small quantity may be sprinkled in the stables every day. It is, in itself, of some value, as it contains sulphuric acid and lime, both of which materials are used either as plant-food, or to prepare food for plants. In the stables it absorbs ammonia (the valuable element of nitrogen) and retains it, thus proving a great help in preventing the waste which would occur without the use of this or some other powerful absorbent. It is specially valuable in horse-stables where the liability of loss is greatest. In most

sections its low price renders this an inexpensive aid in saving the volatile elements of the manure.

Sheep-manure is also a very valuable fertilizer, and should be carefully saved. It is much more efficient in producing crops than either horse or cow-manure. This is owing more to its better mechanical condition, than to a superiority of the materials of which it is composed. Considerable bedding may be used in the sheep-pens to good advantage. For this purpose either straw or coarse hay, cut into short lengths, will do very well. Although it will remain uninjured for a long time if it is let alone, sheep-manure is subject to violent fermentation when it is forked over and exposed to the air. Consequently it should either be composted or else plowed into the ground as soon as it is removed. It should never be used in the hill, or near the seed of any plants, before fermentation is completed.

The pig-pen ought to furnish quite a quantity of good manure. It is one of the merits of the pig that he is capable of manufacturing a large quantity of manure for a comparatively low price. Give him plenty of muck, straw, and other materials, and he will patiently mix and work them over. When properly managed, the manure from the pig-pen will produce heavy crops of corn, and its good effects can be seen many years after the crop to which it was originally applied has been removed. Many farmers take advantage of the industrious habits of the pig and keep him in a shed into which the manure from the horse and cow-stables is thrown. This he thoroughly works over and greatly improves. Sometimes large quantities of muck or sand are added, and are thoroughly incorporated into the mass by the labors of the pigs. This course insures a large quantity of valuable manure, but it is open to many objections. We very much prefer the plan of having a house and yard specially for the hogs. In this yard muck and other material may be thrown and converted into manure. As it is constantly

worked over, fermentation will proceed very slowly and can do no harm. The great things for the farmer to attend to are to keep a proper quantity of material ready for use and to furnish a sufficient, but not excessive, supply of moisture. The first of these requirements is easily complied with, but to arrange the latter in a perfectly satisfactory manner is a matter involving greater difficulty. If the yard is left open, and there are no eave troughs to the house, so that all the water which falls on one-half the roof as well as what naturally belongs there, is poured into the yard, there will at times be so much moisture as to make it very muddy. Though pigs like an occasional wallow in the mire, they do not prefer a muddy place for a permanent home, and will not thrive as well if kept in a filthy place as they will if they have clean, dry quarters. The quality of the manure is also injured by the presence of too much water. But if the yard is covered with a roof it will soon become too dry, and will need the addition of water from a well or cistern. Some farmers roof over part of the yard and leave the rest uncovered. This furnishes a partial remedy for the evils caused by too much or too little moisture. In some way the quantity of water which enters the yard should be controlled, and the material therein kept constantly moist, but never soaking wet.

Poultry-manure is also of considerable value and should be carefully saved. As farmers usually allow their hens free range during the day, the quantity which can be secured from this source is comparatively small. A good shed, or house, should be provided for their night quarters, and the droppings should be removed often enough to keep the room clean. Dry earth may be occasionally sprinkled over the floor, and be made to add to the quantity without greatly injuring the quality of the manure. It should always be mixed with earth before it is used, and ought to be scattered broadcast and harrowed in lightly.

Human excrement is one of the most powerful fertilizers, and though only a small quantity can be obtained, it should be carefully saved and used. The Chinese make great use of this material, and have proved themselves the most successful farmers on the globe. Although we do not want to live as the Chinese do, though our people could not live and carry on their great industries without better food than the Chinese have, yet their example in growing vast quantities of useful plants on small areas, without importing fertilizers, and without diminishing the productive capacity of the soil, although this process has been going on for ages, is worthy of our imitation; and their success, working as they have without scientific knowledge, is one of the wonders of the agricultural world. In the use of this fertilizer in its crude state there is danger of injuring the plants, but if it is properly composted it will promote a luxuriant growth. There should be a daily addition of a little dry earth, or charcoal-dust, to the contents of the privy. If the material is dry, as it always ought to be, it will answer several important purposes. It will prevent all offensive odors, will absorb the urine so that it will not poison the well, it will increase the quantity of the fertilizer, and the whole mass will be of better quality than any part of it would have been without the addition of foreign material, it will make it directly beneficial to the plants, and will also make it as inoffensive to handle as any yard-manure.

It should be remembered that the value of animal excrement will depend largely upon the condition of the animal and the food which it receives. The manure of a fat cow will be much richer in the elements which plants require than that of one which gives large quantities of milk, for in the latter case considerable of the nitrogen and phosphates of the food are used in the production of the milk. A growing animal also requires these elements to build up the bodily structure, and its manure will therefore be comparatively deficient in them. Fat animals which are fed with large quantities of Indian-meal, oil-meal, or

similar substances, furnish very valuable manure. But *all* the manure made on the farm, from each and every source, should be carefully saved. It is the capital of the farmer, and if wasted will greatly reduce the profits of his business.

The following estimate of the quantity and value of the manure made in one year by some farm animals and man, was published by MR. BRUCKNER, in his valuable book on "AMERICAN MANURES:"

	Amount.	Value.
Horse	2,000 lbs.	\$9.94.
Cow	2,000 "	5.15.
Pig.....	200 "	.62.
Sheep.....	50 "	.40.
Human.....	100 "	.50.

In the last three we think the quantity is too small, and the value much too low. By judicious composting the value can certainly be more than doubled. Manure from fat oxen is considered much more valuable than any noted in the table. Some farmers in NEW ENGLAND who buy oxen in the fall, feed them heavily during the winter, and sell them in the spring for beef, consider the manure which they obtain during this period to be worth ten dollars per ox. We consider this a fair but not at all leaning toward an excessive valuation.

COMPOSTING.—The easiest methods of composting have already been indicated. The use of plenty of dry earth, or other absorbents, in the stables, pig-yards, and privies, if attended to at the proper time, will give good results in saving the urine and preventing the escape of fertilizing gases. But as different methods are sometimes preferred, it may be well to note some of those which seem likely to be the most useful. When no absorbent but straw is used, much of the urine in the stables will run through the cracks in the floor into the cellar, or upon the ground beneath. By throwing a few loads of dry muck under these floors in the fall an excellent fertilizer can be secured the next spring. — PROFESSOR PENDLETON, of Georgia, saves the

liquid manure in a tank, under the stable-floor, in which a quantity of ground phosphate and sulphate of lime (plaster) is placed. When well saturated the material is removed and a fresh lot supplied. In this way a valuable ammoniated superphosphate is obtained. The solid excrements are then mixed with bone-dust, or put with it in the land devoted to corn and cotton. When something more elaborate is desired, a compost heap may be made. If properly managed this will be very useful, but on account of the limited means which many farmers possess, and the rapidity with which the work is performed, it often happens that the results are not very satisfactory. If he had enough to do with, the farmer could obtain better results in composting. Still many farmers are convinced that it will pay any one who keeps stock to also have a compost heap. In making such a heap it is a good thing to place boards at the bottom. A high and dry spot should be selected for the purpose. The object in view is to rapidly decompose the substances in the pile, and decomposition cannot go on, to any extent, under water. The heap should be five or six feet high, in order that the rains which fall upon it may not leach it and carry off its valuable properties. A layer of muck, or good loam, a foot thick, may be placed at the bottom. Upon this an equal layer of stable-manure. Then leaves, corn-stalks, straw, and similar substances, may be thrown on and mixed with the manure. Another layer of muck may then be used, followed by leaves and similar substances and covered with manure. The muck may be employed quite freely—two loads of muck to one of stable-manure being a fair proportion. To each load of material twenty-five pounds of plaster should be added. Some farmers mix ashes in the compost heap, but we consider them more valuable to use alone as a fertilizer for special crops. Others throw in old boots and shoes, soap-suds, brine, sawdust, and all such refuse. From these materials a small quantity of plant-food may be obtained, and if properly used they may be made to help in the process of decomposition.

The addition of two hundred pounds of a good superphosphate of lime to each cord of the other materials, if well mixed with the whole mass, will prove of immense benefit. This material most farmers would be obliged to purchase. Those who can obtain it without paying excessive rates for transportation will probably be gainers by using it. Finely ground bone is also a very good addition to a compost heap, and if the superphosphate cannot well be obtained, this may take its place. Of course, the top of a compost heap should be covered with muck or loam. In a few days, if the weather is reasonably warm, fermentation will set in. This will gradually increase to a certain point and then slowly die away. Some farmers attempt to control this fermentation by the use of water which they apply liberally if they think the pile is getting too hot. Others consider water an injury and rely upon the plaster to keep the contents of the heap uninjured. In itself, this fermentation is a great advantage. The only danger is that it will proceed too rapidly and cause the loss of some of the most valuable elements. If this takes place it will be indicated by the escape of vapor which has a strong, pungent odor, similar to hartshorn. If this odor is not apparent the heap is suffering no loss. But when it does appear, ammonia begins to escape, and the value of the material will be rapidly reduced if the fermentation is not at once retarded. There are two ways of checking this evil. The application of water, or, still better, a covering of plaster and a final light coating of dry earth. Some guard against too rapid fermentation by making the compost heap in October and rely upon the cold weather to retard decomposition. When this is done, the heap should be shovelled over once or twice in the spring. When any other system is followed, it is also a good plan to throw over the heap before it is used. Sometimes freshly slaked lime is used in compost heaps, but the practice is not to be commended. It will hasten decomposition and get the heap in condition to use much sooner than it otherwise could

be, but it involves the loss of too much nitrogen to make it profitable.

The time required for the proper composting of manures will vary greatly with the quality of the materials which are used, the way in which they are handled, and the degree of exposure to cold and rain to which they are subjected. The process should not be hastened by lime, and the material should not be used until it is thoroughly broken up and separated into its elements. From six months to two years is usually required, though MR. WARING claims that by the proper use of liquid manure, soap-suds, slops, and similar material (with which a tank is filled when the heap is begun, and from which it is pumped over the mass once or twice a week, and through which it filters back into the tank), a heap can be reduced to fine condition in a single month. We think a longer process is more desirable. When the subject of composting first attracted general attention, many farmers drew large quantities of dirt to their barn-yards in the fall, allowed the cows to stand upon it during the day-time in winter and sleep upon it during the night-time in summer, and the next fall carted it upon their fields. Some used to plow their yards once or twice during the summer, and a few piled up the dirt in heaps. But, incredible as it may seem, many followed the course first described. Such composting as this is not worthy of the name it bears, and is not worth the work which it involves. Simply drawing dirt into a yard and then drawing it out again amounts to nothing. And the quantity of manure which animals leave upon dirt thus used is so small in comparison with the whole mass as to but slightly improve the quality of the dirt itself. But the methods of composting previously described are quite satisfactory, though we very much prefer the use of dry earth, and other suitable materials, in the stables.

GREEN MANURING.—Very few methods of fertilization have been so strongly recommended by their advocates or so severely

denounced by their opponents as green manuring. It is a system which has both advantages and drawbacks, which cannot be universally used, which may be carried too far, yet one from which the average farmer may obtain a great deal of help in his efforts to furnish food for his plants. For making fertile the worn-out lands in some parts of NEW ENGLAND, upon which corn, rye, and buckwheat have been grown until the soil is so utterly worn that it is practically unproductive, and the exhausted tobacco, cotton, and cane fields of the SOUTH, this system seems specially adapted. It requires some time and labor, but does not need much capital. Various crops are used for the purpose. Almost any crop will do, but some are much better than others. Corn, millet, clover, rye, buckwheat, mustard, and turnips have been recommended. For lands which are badly exhausted we prefer buckwheat, as it will grow where corn or rye would utterly fail. After growing two or three crops of buckwheat, some other grain may be tried. The land ought then to be rich enough to produce almost anything which is used for the purpose. Before sowing any crop with a view to enrich the soil by means of green manures a small quantity of well-rotted manure, or two hundred pounds of guano, bone-dust, or grass fertilizer should be applied to each acre of land in order to give the plants a start and feed them until they get well rooted. After getting the land so that it will produce a good crop of clover, the preceding crop should be turned in and a fair quantity of clover seed sown. If manure enough is used to give it a vigorous start, clover may be used as the first crop in the course of improvement. It ought always to be used before the course is completed. This will be evident from a brief consideration of the method by which green manures fertilize the soil. The substances of which they are composed must be principally drawn from some source outside of the soil. Otherwise, there would be no benefit in growing these crops for manure. The land would not need them, for it would just as well grow crops for the farmer to use.

We find that clover obtains a great deal of its food from the atmosphere, and that the mineral elements which it obtains are largely drawn from the subsoil. The long roots of the clover-plant penetrate the hard subsoil and obtain food which other crops, having shorter or weaker roots, cannot secure. The opponents of this system of fertilization claim that if long continued the subsoil will become exhausted and thus the effort to improve the land will fail. But, on the other hand, it is thought that the decay of the mass of roots in the subsoil hastens the disintegrating process which is always going on, and that under this influence it will furnish a full supply of plant-food as fast and as long as it is wanted. Doubtless there are extremes either way, but there can be no doubt that on many worn-out soils, green manuring has worked a complete restoration to fertility. JOSEPH HARRIS, who is an acknowledged authority, calls clover "the grand renovating crop of America." Although it has long been used for a fertilizer in some sections, clover does not seem to have come into general use for this purpose. That it will be more largely grown in the future is both to be hoped and expected. It is cheaply grown, easily used, and almost always gives satisfaction. In the few cases which have been reported where green clover has "soured" the soil the difficulty can be directly traced to an improper method of using. And it is a noticeable fact that some who are opposed to the use of green clover are strongly in favor of growing it for use as a fertilizer when dry. On light soils there is very little danger of injurious fermentation taking place. The same is true in heavy soils if the plowing is shallow. But if deeply covered in such soils, temporary ill effects may be observed. For these soils it has been recommended that the first crop of clover be cut when in full bloom, the second crop allowed to grow up through it, and that when the second is sufficiently matured it should be cut and allowed to decay for a while before the land is devoted to the production of a crop which is to be

removed. By following this plan all the evils will be obviated and nearly all the benefits will be secured. Or if it is desirable to plow oftener, a coating of lime may be sown upon the clover, and it can be turned in without injury. The principal objection which can be brought against clover is that it is sometimes difficult to get it started. The young plants are feeble, and if the weather is unfavorable many of them die. Some seasons we have splendid success with it, while in other years the seed fails. This is a quite common complaint. DR. HARLAN, in his small but able and comprehensive work on "*FARMING WITH GREEN MANURES*," has suggested as a remedy that buckwheat should be sown with the seed. When the buckwheat is in blossom it can be cut, will mulch the clover, and be a great aid in securing a good crop.

Another important consideration is whether clover can be used constantly and be made to supply the place of barn-yard manure. If it can, it must be evident to all observers that it is a great desideratum for farmers who own land at a distance from their buildings, to which it would be both laborious and expensive to apply the contents of the barn-yard, and for all who have an insufficient supply of yard-manure. If used with care we see no reason why it may not be used continuously. HON. GEORGE GEDDES said, a few years ago, that he had a field which for seventy-four years had been manured with nothing except clover grown upon it and plowed in; that he has grown wheat, corn, oats, barley, and grass, on this field; that the clover has for fifty years been regularly treated with gypsum, and that the land is increasing in fertility. Other fields have been treated by less noted writers for shorter periods, but long enough to prove that a judicious use of clover can be long continued and steadily produce the best of results. Some farmers mow the first crop, use it for hay, and plow in the second, while others, on good land, mow and feed two crops and merely plow in the roots. Of course, the greater the quantity of material

which is left upon, or plowed into the soil, the greater will be the benefits resulting from the green manuring. Doubtless the land may be improved by taking off the tops of a good clover crop and plowing in the roots, but the increase in fertility will, of necessity, be comparatively slow. To get large crops and improve the land at the same time and by the same means is a somewhat difficult operation. Too much in this line should not be attempted.

We have treated thus at length of clover because we consider it the representative crop for all purposes of green manuring. Many farmers favor the use of corn, others of millet, and still others of the various other crops which we have named in connection with this subject. Under certain circumstances, some of these crops may be superior to clover. This has already been suggested in relation to buckwheat. No special directions are needed for these crops, except the caution that when some of them are grown, care should be taken to either plow or cut the first crop before it matures its seed.

Although not produced for the specific purpose of furnishing food for plants, sod is a very valuable fertilizer for the ordinary farm crops. We call attention to it here because we think its value is greatly underrated. We know many farmers who keep their land in grass as long as they can obtain fair crops—sometimes until it is almost “run out.” If they realized the great value of a heavy turf for plant-food they would plow their grass lands while they were quite productive. Probably many farmers have noticed that some of their best grass fields produced better corn when planted upon the inverted turf than they did during the succeeding seasons who have not traced this effect to its cause. They have not thought that in the roots and stubble of the grass vast quantities of food for the corn were contained. There seems to be little doubt that the weight of this material will range from fifty tons per acre in light turf to one hundred tons in a heavy sod. Such a vast quantity of material, containing as

this does, the elements of fertility in a high degree, cannot decay in the soil without furnishing an immense amount of plant-food.

The substances which we have thus far considered as the sources of supply—animal excrement, compost, green manure, and sod—are all in the line of complete manures. Some are better than others, but each one is supposed to contain, to a certain degree, all the elements which it is necessary to supply to the soil in order to promote the growth of plants. In addition to these there are several valuable fertilizers each one of which furnishes only a part, but a very important part, of the elements required. One will supply the farmer with potash, another with phosphoric acid, while others will supply other elements which the plants need.

WOOD-ASHES ought to hold an important place among the manurial resources of the farms in those sections in which wood is used for fuel. They furnish large quantities of potash in an easily available condition, act quickly, energetically, and with a considerable degree of permanence. They ought to be carefully saved, and should be kept quite dry until they are used. Ashes from hard woods are much better than those from the soft species, though these are very useful. Leached ashes upon some soils give good results, but for general use they are much inferior to those which remain in their natural condition. Leaching removes nearly all of the potash, together with a part of the phosphoric acid and lime, but enough of the latter remain to make them very useful to crops in which potash in large quantities is not an essential ingredient. Coal-ashes are of but little value for fertilizing purposes, but are said to be useful in small quantities around pear trees, and they sometimes improve the mechanical condition of heavy soils.

MARL, a soil containing clay, lime, and other materials, is also a source of supply for farmers living in the vicinity of its deposits. Some beds of marl contain larger quantities of clay than others,

and it is, in other respects, of variable composition. The green-sand marl of NEW JERSEY, the best which has yet been discovered, contains lime, potash, silicic acid, sulphuric acid, and phosphoric acid, in quantities sufficient to make it a valuable fertilizer. Those who live near marl beds should test their value for fertilizing purposes.

COMMON SALT supplies plants with soda and chlorine—both constituents of plants—the former an element which is occasionally needed from outside sources, while the latter is seldom required in larger quantities than can be furnished by the soil. Its greatest value consists in its power to render other plant-food which the soil may contain more available. Not more than five or six bushels per acre should be used at a time, and this application will not need frequent repetition. There are many soils, too, which contain silicic acid (common sand) in abundance, but in which it does not appear in an available condition. This is especially true in sections where grain-growing has long been a prominent industry. It is made apparent by the weakness of the straw and the consequent falling down, or lodging, of the grain. When this occurs, salt should be applied to the soil to combine with the sand and make it available for the plants. There is no need of applying sand to any kind of soil merely for plant-food. For this purpose there is enough there already. If it can be made available it will furnish all this kind of food which is required. Ashes, or potash in other forms, will tend to make it available, but will usually be found much more expensive than salt. On stiff, heavy soils the application of sand in order to improve their mechanical condition is sometimes advisable, but for merely feeding plants it is far better to use an alkali to act upon the sand already in the land.

PLASTER, or GYPSUM, supplies plants with sulphuric acid, and with very small quantities of sulphur. But its principal value is as an absorbent of ammonia. It is useful to sprinkle in stables, privies, and the compost heap. On many soils its application

produces an immediate effect in increasing the yield of crops, while on others it seems perfectly useless. Where its effect is beneficial it needs judicious handling. Within sight of the window by which we are writing there are many worn-out fields, which the older inhabitants say have been ruined by plaster. It was found that plaster alone would produce good crops upon this land, and the owners cropped it year after year until plaster had no effect, and the crops were not worth the cost of gathering them. Here plaster acted as a stimulant. It seemed to unlock all the treasures of plant-food which the soil contained, and finally left it utterly barren. If clover had been grown and plowed in once in two or three years, or if manure had been occasionally applied, so as to return to the soil the elements which the crops removed, plaster might have been used with good results. But alone it proved like the whip to a jaded horse—making him go until the last possible moment, and leaving him worthless. It is much better to feed and rest a tired horse than it is to keep him going by means of the whip. Precisely the same principle applies to the use of the land. Upon soils which show no immediate improvement under the use of plaster it will not pay to apply it. We have seen it sown upon a nice field in strips which were liberally coated, but upon which the succeeding crops showed no increase over the rest of the field. We should never buy plaster to use on such fields.

BONES furnish large quantities of phosphate of lime, together with considerable nitrogen. Consequently, they are extremely valuable for fertilizing purposes, and produce good results upon nearly all soils, and with nearly all kinds of crops. In their natural state they act very slowly. Therefore they should be subjected to some process for making them more immediately available. The finer they are made the more rapidly and profitably they will act. There are various methods of reducing bones to a finer state. Burning accomplishes the purpose, but it drives off the nitrogen and thus diminishes the value of the

material. Grinding, in a mill made for the purpose, is very much to be preferred. The finer the powder into which they are made the better. If no mill is at hand, bones can be reduced by composting with ashes, but considerable time and some care is required. A water-tight barrel, or hogshead, should be used. Into this bones enough to fill it three inches in depth should be placed, upon them an equal quantity of the best wood-ashes, then more bones, covered as before, until the supply gives out or the barrel is full. These should be kept always wet. A little plaster, or weak sulphuric acid, may be occasionally thrown upon the mass with good results. Bones treated in this way will not be ready for use in less than a year. When thoroughly softened they should be taken out, broken into fine pieces, and applied to the land. The ashes will also prove an excellent fertilizer. By adding sulphuric acid to the ashes of bones superphosphate of lime is obtained. This is a valuable fertilizer—one of the most valuable which can be obtained. It is very readily dissolved, and consequently can be easily used by plants. It supplies phosphoric acid in a form in which it can be taken by plants in the early stages of their growth, while its action is lasting enough to carry them through the season. For grain crops and pastures this fertilizer is of special value. On many soils the addition of this one element will, for years, produce good crops, while without it, though manures deficient in this substance may be applied, the land will yield but very small returns for cultivation. We do not approve of using one element alone to any great extent, but call attention to the fact that this one can be so used in order to show its immense importance to the practical farmer. In obtaining this substance there are two difficulties with which the farmer will have to contend. One is the difficulty of obtaining bones without being obliged to pay more than they are worth, while the other is found in the danger of handling sulphuric acid. A very few bones can be saved on the farm, but the quantity to be secured in this way is quite

limited. They can be bought in the cities and large towns, but fertilizer manufacturers are generally ready to pay well for them. The acid needs handling with the greatest care. We have spoiled too many clothes, and had our hands made sore too often to recommend the use of this material without giving a caution concerning its use. As a general thing we think it is better for the farmer to buy his superphosphate ready made. Men who are engaged in the business on a large scale, and have facilities for its prosecution, can make as good an article and do it much cheaper than the farmer. But care must be taken to secure it of well-known, or fully responsible, manufacturers, for a great deal of miserably poor material has been palmed off upon our farmers for genuine superphosphate. Thanks to the fertilizer laws in many of our States, such swindles are now much more difficult to perpetrate than they were a few years ago, and are quite likely to involve the unscrupulous dealer and maker in a great deal of trouble.

Another source of supply of phosphoric acid is furnished by the mineral phosphates which are found in various parts of the world. One of the largest deposits yet discovered is in SOUTH CAROLINA, near the city of CHARLESTON. These mineral phosphates should be treated with sulphuric acid, as they are not soluble to any extent in water. When properly managed they are capable of producing the best of effects upon crops, and it is highly probable that the discovery of this material will have a very beneficial influence upon the agriculture of the Southern States.

LIME.—Although the use of lime is considered by many farmers, and by some agricultural writers, as the very foundation of successful farm-business, it is by others believed to be useless if not actually injurious. We do not think it as valuable as it has many times been called, but believe it may, in many sections, be very useful. As far as the mere feeding of plants is concerned, we consider its application useless—certainly so

on all soils of granite or of limestone formation. Only a very small quantity of lime is used by plants, and enough to supply their wants can be found in almost any soil. But it often proves a great aid to the farmer by hastening the decay of vegetable matter which is already in the land, but in a condition in which it is unavailable for plant-food. It thus furnishes nitrogen, and by breaking up and fining the coarser particles of the soil, liberates the mineral elements which crops require. Upon soils which contain too much acid, and produce sorrel and other weeds better than they do corn and wheat, lime is especially useful, as it corrects the acidity, and fits the land for the production of useful plants. The idea which many have that lime exhausts the soil is not supported either by theory or practice. When properly applied, lime will work such changes in the soil as will make the fertilizing elements immediately available, but will not allow their escape in the air. The crops will be larger, and large crops to which no real plant-food has been applied *always* mean exhaustion to the soil. But in such cases the exhaustion is caused by the crops, of which the farmer has the full benefit.

Lime should always be sown upon the surface—never plowed in. It sinks in the soil, and should be only slightly covered or not covered at all. We strongly favor using small quantities at frequent intervals. Ten bushels per acre on ordinary soils is enough to begin with. If the effect is favorable, the same or a larger application can be made in two or three years. Upon soils which are badly worn, and contain but little organic matter, lime should be used quite sparingly, if at all; while on land containing large quantities of organic material it can be applied more freely. Shell-lime is considered the best, but in many sections cannot be obtained, except at great cost for transportation. When stone-lime is used, the purest kinds should be obtained. It should be slacked with salt water before being applied, except in those cases in which it is used merely to

decompose organic matter in the soil. For this purpose it may be applied without slacking.

GUANO.—In addition to the supply of nitrogen furnished in various forms by the atmosphere, and the decay of organic material in the soil, guano furnishes one of the great sources from which this important fertilizer is obtained. For, although some brilliant writers have claimed that there is no necessity for the farmer to supply nitrogen to the land, the results of a multitude of experiments seem to prove beyond question that the addition of this material will largely increase the yield of our principal farm-crops. On some soils its effects are better than upon others; but where the land has been long under cultivation, its judicious application can hardly fail to be beneficial. Land which is greatly deficient in mineral elements will not be perceptibly benefited by the addition of nitrogen alone, but nitrogen in connection with the wanting inorganic elements will usually produce better and more permanent results than can be secured by the use of only the mineral matters. We do not favor the using of guano alone, but consider it a valuable fertilizer when properly applied. The same should be said of the sulphate of ammonia, which furnishes a great deal of nitrogen to crops. Near the sea-coast large quantities of fish are used for fertilizing purposes. In some places the oil is removed, but this does not seriously injure the material as a fertilizer. The refuse is broken up by machinery, and sent out in bags and barrels under the name of "fish guano." It furnishes large quantities of nitrogen in one of its cheapest forms, and also considerable phosphate of lime. It should be mixed with twice its bulk of dry earth, scattered broadcast, and immediately harrowed in, or else covered by a shallow plowing. In no case should it be used in the hill. The quantity to be used will depend upon its condition. The less water it contains the less weight will be needed per acre. We have used the "half dry" at the rate of about ten hundred

pounds per acre with good results. For us it is cheaper than PERUVIAN guano, but, as it is less concentrated, it would not be as cheap for farmers living far inland, and in some places the freight would be too expensive to justify its use.

Nitrogen is also obtained from many of the waste products of the farm. It is present in leather, but, as this decomposes very slowly, a long time is required to make its fertilizing qualities available. Old boots, shoes and harnesses may be buried under fruit trees and prove of some value. The same is true of woollen rags. When an animal dies, the body may be made to furnish both nitrogen and phosphate of lime for the use of crops. It should be cut in pieces, and mixed with a large quantity of dry muck or loam. But this should *not* be done near buildings, and should *never* be attempted in the case of an animal dying from a virulent disease. In all such cases the body should be deeply buried at a distance from any house or barn, and then be forever let alone.

The LEAVES of trees can be made to supply small quantities of plant-food. Those from the walnut, oak and horse-chestnut trees are better than leaves from the beech, fir or pine. Leaves furnish small quantities of phosphoric acid, potash and lime. They should be gathered when damp with dew or rain in order to facilitate handling them, but they ought to be dried before being stored for use in the winter. The best way to use them seems to be to throw them under the cattle for bedding, though some prefer to put them into the compost heap. We think some writers have greatly overestimated the value of leaves as a fertilizer. They have been misled by confounding the effect of manure with that of covering the soil, and have ascribed to the former what was chiefly due to the latter. Both for the sake of neatness, and also on account of their real value, leaves which fall or are blown around the buildings should be gathered and converted into manure, but we do not think it will pay to go long distances to obtain them.

We have thus indicated some of the sources from which the farmer may obtain the necessary materials for promoting plant-growth. In the list we have included several of what are known as "commercial fertilizers." The latter may be made very useful, or may cause the farmer a heavy loss. Much will depend upon his selection of the kinds, and his skill in using them. If he buys nitrogen when phosphoric acid is what his plants need, he will not be successful; while the use of phosphoric acid when nitrogen is indicated will be just as bad. In any case he should make the most of his own resources, and use all the manure from his yards to the best advantage. A farmer who should buy hay of his neighbor and never cut that which grew upon his own land, would be called very foolish and soon be ruined. Yet this practice would closely resemble that of one who should buy commercial fertilizers, while neglecting to secure the greatest quantity and best possible quality of manure from his own farm.

When certain lines of farming are pursued, it is not always possible to obtain all the manure from home sources which might profitably be used. Where grain is sold from the farm, large quantities of phosphoric acid are removed. The same is true where young cattle are grown and sold, and where the milk business is made a specialty. In these and similar cases, the ordinary system of farming, even where considerable care is taken to save all the manure, will not prevent a gradual exhaustion of the soil. Consequently, from some outside sources fertilizing material should be obtained. Until quite recently the doubt which most farmers felt about what material to use, the manner of its application, and also the certainty of the high price of fertilizers, has prevented a general call for anything of the kind. But science and careful experiment have come to the aid of the farmer, and by providing what are called "SPECIAL FERTILIZERS" have shown him what to use and how to make the application. To the farmer who has not a suffi-

cient quantity of manure to feed all his crops these special fertilizers are an immense benefit. They are made upon the principle that different crops take the elements of plant-food from the soil in different proportions, and that if the farmer will supply to any particular crop just those materials which it needs, he can invariably obtain large returns. This system not only supplies just what the plants want, but, what is almost as important, furnishes their food in the best possible condition.

Here is where special fertilizers have a great advantage over barn-yard manures. While the latter contain all the needed elements, they are not in a condition in which they can at once be used by crops. Before they can be made available various chemical changes must be passed through. The phosphoric acid, potash, and other mineral elements, must be rendered available by means of the carbonic acid which is generated by fermentation. Now if green stable-manure is applied to the corn crop in the spring and the weather is very wet and cold, fermentation is checked, and the elements of fertility are no more available than they would be if they were in another field. The corn looks yellow and sickly, and does not grow, because, though there is a liberal supply of manure within reach, that manure is not in a condition to be used, and the crop has nothing upon which to feed except what it can obtain from the soil. Thus when the plant needs manure the most it does not have any. In a warm season this does not occur, as fermentation goes on rapidly enough to keep a supply of food constantly ready for the plants. It is on account of the slowness with which barn-yard-manure decomposes that its effect is perceptible in the soil so long after its application, often lasting many years. Special fertilizers are not designed to last more than one or two years, and as interest on the money invested increases with great rapidity, it is best for the farmer that they should not be made so as to have a permanent effect. As MR. WARING has said in his "ELEMENTS OF AGRICULTURE" farmers are apt to attach "too

much importance to the *lasting* qualities of a manure. Generally they are *lasting* only in proportion as they are *lazy*." If money is to be invested in a fertilizer, it is best that one which will give a quick return should be obtained. This is the general rule. There are cases in which it pays to buy material which will be permanent in its effects. But material which works slowly should be obtained for a low price.

The objection has sometimes been raised against special fertilizers that the quantity applied is insufficient. It seems to the farmer that the large loads of barn-yard-manure which he is in the habit of using must contain a great amount of plant-food, while the small bags of special fertilizers can certainly contain but little. Even if all the material of these special fertilizers were pure plant-food, he thinks there would be so little of it that large crops could not be produced. Here the great mistake of considering bulk equivalent to quality is made. It is based on two popular misconceptions: first that the crop takes a large quantity of material from the soil, and second that barn-yard-manure is nearly all pure fertilizer. But chemistry shows us that while a medium crop of corn weighs about six thousand pounds, only about three hundred pounds of the material of which it is composed are taken from the soil. This includes the ammonia—much of which comes indirectly from the air. Thus it will be seen that the air and water supply nearly all of the weight and bulk of our cultivated crops. If any reader is disposed to doubt this, let him burn ten pounds of corn, or any other crop, and carefully weigh the ashes. He will find the quantity very small, but it will represent all the material which had been taken directly from the land. With many crops the weight of the elements taken from the soil is much less than that given for corn. Then the barn-yard-manure is overrated by not distinguishing between what is valuable and what is useless. DR. NICHOLS has shown that in three thousand pounds of common barn-yard-manure there are twenty-four

hundred and fifty-six pounds of water and one hundred and thirty-eight pounds of sand—articles which for the farmer to apply for merely fertilizing purposes are worthless. There then remain three hundred and thirty-two pounds of carbonaceous matter which has the same value as muck, and “only seventy-four pounds of active fertilizing material which has a money value.” PROF. STOCKBRIDGE put the truth indicated in these figures in a very clear form when he said that he could take a basket on his arm and carry into the field a quantity of material which would not weigh more than twenty-six pounds, but in which should be more plant-food than would be contained in an ox-cart full of the best barn-yard-manure. Except upon some soils which need to be made more open and porous, the great bulk of barn-yard-manure does no good. Upon all other soils this extra bulk is used at a disadvantage, for it involves the carting and handling of a great mass of material in order that a small quantity of really fertilizing matter may be secured. The farmer who allows his manure-heaps to lie out in the rain and be exposed to the sunshine, still further increases this disadvantage. For he will be obliged to handle a great deal more water, and the manure will contain a much smaller quantity of really fertilizing matter than would be the case if it were kept from undue exposure to the weather.

Barn-yard-manure should be saved with the utmost care, and muck, or similar material, should be used to increase the quantity and improve the quality; but when the supply is exhausted, the farmer may be sure that he can obtain fertilizers equally good, by purchasing those which are compounded by responsible parties for the production of special crops. We much prefer the use of special fertilizers to the application of single elements. If properly made, the special manure will certainly (if no disease or accident, to which all crops are exposed, destroys it) produce a fair yield, but if the farmer tries single elements, he will be liable to make great mistakes. He may

use ammonia or phosphoric acid when his land needs potash, or he may apply potash and phosphoric acid when his land needs ammonia, and so on through all the many changes which may be made with these three elements. If he gets *the* right one, his crops will be good, but if not, his expense and labor will be nearly all in vain. This is strikingly illustrated by an experiment of the celebrated MR. LAWES, of ROTHAMSTED, ENGLAND. Upon land which without manure had produced sixteen bushels of wheat per acre for more than twenty successive years he applied phosphoric acid, potash, lime, and other substances, including *all* the mineral elements which a large crop would require, and only raised the yield to twenty-five bushels per acre. But by adding eighty pounds of nitrogen per acre, the yield was brought up to thirty-six bushels, and was maintained at that point for years. Upon part of the same land fourteen tons of good barn-yard-manure per acre were used, and only brought the yield to the same figure as the nitrogen. This quantity of manure contained much more nitrogen than was applied in the form of chemical fertilizers, but it produced no larger crops because a large part of it was unavailable during the first season. Its permanent effects were probably much greater than those of the chemicals. Lest this experiment should mislead, it should be said that the soil in England is very different from our own, and that while nitrogen seems to be demanded there, potash and phosphoric acid seem to be required here in larger proportion.

It is well enough for the farmer to experiment to some extent with single elements, with two combined, and with a combination of different materials, but we think he will more surely secure just what he wants by buying, when he is obliged to buy anything of the kind, the fertilizers which are made for special crops. They will cost him less, keep his land in better condition, and give him larger crops. By using the special manures, and occasionally applying a liberal coating of barn-yard-manure, or a

complete commercial fertilizer, the land can be made to produce large crops, and also be kept in a high state of fertility. The special fertilizers have been tested for years upon all kinds of soils, and when made by responsible parties have proved strictly reliable. To PROF. STOCKBRIDGE, of the MASSACHUSETTS AGRICULTURAL COLLEGE, a great deal of credit is due for his careful investigations and experiments which have resulted in the discovery of the fertilizers which bear his name. We believe that wherever the land has been exhausted by excessive cropping, and barn-yard-manure cannot be had, these fertilizers may be made the direct means of bringing the soil back to its original productiveness. In addition to the STOCKBRIDGE fertilizers, and with them ranking as strictly first-class, may be named the "FORRESTER," originated by GEORGE B. FORRESTER, and the "MAPES," which are made from formulæ prepared by CHARLES V. MAPES. The "STOCKBRIDGE" are manufactured principally by W. H. BOWKER & CO., of BOSTON, the "FORRESTER" by H. J. BAKER & BRO., of NEW YORK, and the "MAPES" by the MAPES FORMULA AND PERUVIAN GUANO CO., of NEW YORK. The latter Company also manufacture fertilizers made after the formulæ of PROF. VILLE, the renowned FRENCH agricultural chemist. These are, at this writing, the principal manufacturers of fertilizers for special crops. They are all worthy of confidence in the highest degree. Each of the formulæ named above make use of the same materials, but in different proportions. Some give potash a higher place than others, while some rely in a greater degree upon nitrogen and phosphoric acid than upon potash.

The formulæ for the STOCKBRIDGE fertilizer are carried out in pounds. In order to show clearly how much, or rather how *little* plant-food is required, when it is all in a form in which it can be easily taken by plants, we quote the formulæ for a few of the leading crops.

INDIAN CORN.—*For an Acre.*

Nitrogen.....	64 lbs.
Actual Potash	77 “
Soluble Phosphoric Acid.....	31 “

The above elements are contained in from 700 to 1,000 pounds of the crude materials, and are designed to produce fifty bushels of shelled corn more than the natural yield of the land.

WHEAT.—*For an Acre.*

Nitrogen	41 lbs.
Actual Potash	24 “
Soluble Phosphoric Acid.....	20 “

These elements are obtained in from 450 to 600 pounds of crude materials, and are designed to produce twenty-five bushels of wheat in excess of the natural yield of the land.

OATS.—*For an Acre.*

Nitrogen.....	23 lbs.
Actual Potash	20 “
Soluble Phosphoric Acid	12 “

Contained in from 300 to 400 pounds of crude materials. Intended to produce an increase of twenty-five bushels.

RYE.—*For an Acre.*

Nitrogen.....	25 lbs.
Actual Potash.....	24 “
Soluble Phosphoric Acid	16 “

Requiring from 300 to 400 pounds of crude materials, and designed to yield an actual increase of twenty bushels.

POTATOES.—*For an Acre.*

Nitrogen.....	21 lbs.
Actual Potash.....	34 “
Soluble Phosphoric Acid	11 “

Obtained in from 400 to 500 pounds of crude materials, and designed to yield an increase of one hundred bushels.

HAY.—*For an Acre.*

Nitrogen.....	26 lbs.
Actual Potash.....	31 “
Soluble Phosphoric Acid.....	8 “

Requiring from 250 to 350 lbs. of crude materials, and designed to produce one ton of hay more than the natural yield of the land.

The reason why such small quantities of fertilizers produce such beneficial effects is due to the fact that they present exactly the food which the plants require, and also to their being made extremely fine; a condition into which all plant-food must come before it can be used.

For Sugar-Cane and Cotton, we believe no special fertilizers are made except by the MAPES Co., though other dealers would probably furnish them if there were a reasonable demand. Sugar-Cane requires, according to the MAPES formula, a fertilizer containing from two to three per cent. ammonia, ten to twelve per cent. phosphoric acid, and six to eight per cent. of potash. This will prove valuable for either the Southern cane or the Sorgo, and will largely increase the amount of saccharine matter in the stalks. For Cotton, MAPES' NITROGENIZED SUPERPHOSPHATE is recommended. This contains from three to three and a half per cent. of ammonia and ten to fourteen per cent. of available phosphoric acid. A "COMPLETE MANURE" is also manufactured. That sent out by the MAPES Co. contains six or seven per cent. of ammonia, ten or twelve per cent. of phosphoric acid, and three or four per cent. of potash. In this connection DR. NICHOLS' formula for imitating barn-yard-manure should be given. This requires one cord of seasoned muck, sixty-five pounds of crude nitrate of soda, two bushels of wood-ashes, one peck of common salt, ten pounds of fine bone-meal, two quarts of plaster, and ten pounds of epsom salts; all carefully composted. This is said to act rather more slowly than manure, but to be more lasting and to insure good returns.

APPLICATION OF FERTILIZERS.—In the formulae quoted, and in the preceding remarks, we have endeavored to show the kind and quality of food which crops require. As the effect of fertilizers depends in a great degree upon the manner in which they are used, a little space may well be devoted to a consideration of the best methods of application. To some extent these will vary with the quality and kind of the fertilizer and the condition of the land. The general tendency of manures is to gradually sink deeper into the soil. This fact would indicate that surface application is the most desirable. But this is open to the objection that, when exposed to the air, some of the ammonia which manure ought to contain is evaporated, and thus the quality of

the fertilizer is injured. Twenty years ago this was considered an insuperable objection, and almost every farmer was careful to cover the manure which he used deeply in the soil. In our earlier farming days it was the common custom to plow in the manure even on sod-land. When the sod was heavy and deep plowing was practiced, the manure made but little difference with the crops the first season, and a large part of its fertilizing elements got washed down so low that subsequent crops failed to reach them. Experience demonstrated that this was a very unsatisfactory way of using manure, while the results of experiments which a few leading farmers had carried on seemed to point to surface application as very much to be preferred. This seems to be the most reasonable way in which to use manures. In the early stages of life, plants need to have their food very near them. Their roots are short and can go but a little distance for nourishment. If there is plenty of good food in a readily available condition, the plants will grow with great rapidity and obtain a start which will do much toward carrying the crop to a successful issue. But if their food is at the bottom of the furrows, the plants will grow very slowly until the roots reach that depth. Then the growth will become more rapid, but it may be too late to secure the best yield which might have been obtained.

JOHN JOHNSTON once favored plowing in manure, but experience taught him that it was not the best way in which it could be used. After using it only as a top-dressing for twenty-six years he said that he considered one load used in that way "worth far more than two plowed under on our stiff land."

That it makes more difference upon heavy than it does upon light soils probably all advocates of top-dressing will admit. But the great principle that it is best to put plant-food within reach of the roots of plants in the early stages of their growth is always to be kept in mind. Surface manuring answers this requirement, and as the roots of plants increase in length the rains

wash their food down to them. But if plowed in, the manure is so far off that the plants can make no use of it for a long time, and very much of it will be carried beyond their reach. The theory that the fertilizing elements which are deeply buried will be brought again to the surface by capillary attraction does not seem to hold good in practice. There are certain circumstances under which it is advisable to plow in manure lightly, but we doubt if deep covering is ever an economical method.

Where green manure is used, and it is desired that fermentation should take place in the soil, light covering is beneficial, but deep plowing would greatly retard, if not entirely defeat, the purpose for which it was tried. This is true of green crops which are plowed under for fertilizers, and also of green stable-manures. Sod should not be plowed very deep, because such a course would prevent the rapid decay of the roots and stubble which ought to be converted into plant-food. Lime sinks very rapidly, and ought always to be used upon the surface. Plaster and salt, when used by themselves, each have their most beneficial effect when sowed broadcast. Ashes, guano, fish refuse, special fertilizers, and nearly all the agricultural chemicals, should be harrowed in before the seed is sowed. With guano, and some of the stronger chemicals, it is best to mix at least an equal bulk of dry earth before the sowing is attempted.

The waste which has been supposed to be inseparable from surface applications of manure has been greatly overestimated. Alternate sunshine and rain will nearly spoil manure which is exposed in the barn-yard, but most of the loss goes downward. Except during the process of fermentation there is not a great loss by means of exposure to the air. Consequently, when manure is spread upon the surface of the land, this very exposure enables the rain to carry its fertilizing elements directly to the roots of the plants. The slight loss by escape of ammonia in the air is far more than balanced by the increased effect of

the remainder. Every farmer has noticed that manure dries quickly after being spread. Just as soon as it is well dried, chemical action ceases, and there is no further loss. The dews and rain will dissolve and carry it into the soil. When green stable-manure is spread upon grass land, a moderate coating of plaster should be sowed upon it as soon as the spreading is done. This will both hasten decomposition by absorbing moisture from the air, and also prevent the escape of ammonia before the manure is dry. We do not often use green manure in this way, but have seen splendid results from it upon some soils.

THE QUANTITY WHICH SHOULD BE USED will depend upon the quality of the manure, the condition of the soil, and the requirements of the crop which is to be grown. The securing of a large crop is not the only thing which the farmer should keep in mind, but, while very important, must be subordinated to profitable cultivation. There can be no doubt that there is a limit not only to the yield of farm crops, but also that the limit of profitable production falls considerably inside that of the possible yield. By applying a vast quantity of manure we could probably grow one hundred and twenty-five bushels of shelled corn upon an acre of land, but it is much better for us, not only as far as the present corn crop is concerned, but also when considering the products of the land for the next four or five years, to put this manure upon two acres and obtain from sixty to seventy-five bushels per acre. After reaching a certain limit every additional bushel of corn is grown at a largely increased expense. Until that limit is reached every additional bushel is secured for a low price, and brings a large percentage of profit. Thus a field which produces only thirty bushels per acre may be brought up to fifty bushels for so low a price that the cost per bushel of the extra twenty bushels will fall far below the cost per bushel of the original thirty. But after reaching a yield of fifty, or possibly sixty, bushels, the cost per bushel will rapidly increase. The same principle applies to all

farm crops. It is not, as a general rule, policy to grow either small, or excessively large, crops, and fertilizers should always be used with this fact in view. In the formulæ for special fertilizers which we have quoted, a certain quantity was stated as being required to produce a certain yield. Many farmers have applied two or three times the formulæ, and secured largely increased crops. But there is a limit beyond which sunshine, air, and water cannot go. Room is also necessary for the development of plants, and the cash outlay for extra fertilizers is so large that the experience of both farmers, and those who have merely conducted experiments, goes to prove that it is not best to attempt to obtain too much from a small area of land. Besides, an *excessive* use of manure involves an actual waste. Plants can use only a certain amount of food. When that quantity is furnished, it is useless to give them more. When a man has all the food he can eat, he is just as well supplied as he would be if he had placed before him food enough for an army. Precisely the same may be said concerning a plant. Now if twenty-five loads of manure per acre will supply all the food which corn *can* use, and furnish it in good condition for the crop, it is easy to see that the application of thirty loads will involve a loss. The extra five loads can do no possible good where they are, but would have manured one-fifth of another acre of land so that it would have been very productive.

But while it is possible to err in this direction, we think there are ten farmers who apply too little manure per acre where there is one who uses too much. Every farmer knows that it is worse than useless for him to keep more pigs than he can feed properly. He can see that it is better for him to have a dozen nice, thrifty, fat pigs, than it is to have twenty lean, coarse and starving ones. It should be just as easy to see that it does not pay to try to grow any more plants than there is manure enough furnished to feed. It saves time and labor, and is better for both the farmer and the soil, to obtain fifty bushels of corn

from one acre of land, than it is to go over two acres for the same quantity. While it is possible to lose money by using too much manure, it is also possible to lose not only money, but time, labor, and even faith in farming, by applying too little. Both extremes should be carefully avoided.

THE SUMMER FALLOW.—Although it is an indirect method for accomplishing the result, the old ENGLISH system of summer fallowing should be mentioned among the resources for increasing the fertility of the soil. Some writers assert that the mere resting of the land can do no good, but the results of the process indicate that certain advantages can be obtained from its use. The theory of this system is, that the soil contains large quantities of plant-food in a condition which prevents their being at once available for the use of crops. When a crop is removed, the land has been drained of the elements which were ready for its food. The disintegrating process which is constantly going on will unlock and make available more food before time for another sowing or planting; but, if the land can remain uncropped during the next summer, the quantity of food which can then be furnished will be greatly increased, and, consequently, much larger crops can be secured. LIEBIG considered this method of restoring fertility “highly important,” and said that the fact of its beneficial influence had “been fully established by the experience of several thousand years.” In this country it has never been extensively followed, although some of our best farmers have been aware of its benefits. JOHN JOHNSTON has practiced it upon some of his wheat fields with great success. But most of our farmers, even those who are anxious to keep the fertility of the land up to the highest point, and who also desire to obtain large crops, think the end can be secured with less expense by following a suitable rotation of crops. In this we think they are correct, though there are many cases in which the fallow will pay. The following improvement upon the plan of merely resting the land has been suggested by DR. HAR-

LAN. As the success of the fallow is largely increased by occasionally plowing the land, there is an opportunity to use green manures at a merely nominal cost. By sowing clover, buckwheat, or some other crop, when the land is plowed, the expense will be but slightly increased and all the advantages of green manuring will be secured. The plowings should be at least six weeks apart if nothing is grown. Upon good land this will give plenty of time to secure the growth of quite a quantity of material for fertilizing purposes. This seems to be a better plan than that of leaving the land entirely idle.

COVERING THE SOIL.—This is one of the most effective of all the indirect methods for restoring old fields or maintaining the fertility of those whose productive power has not been impaired. It should not be used alone, but in connection with the application of some material containing plant-food. With green manuring it produces highly beneficial effects. Probably every farmer has noticed that when a pile of old boards has been removed, the soil has sent up a large growth of plants. The land upon which muck has been piled becomes very productive when the heaps are taken away. Probably much of the benefit caused by top-dressing is due to the shading of the land which it involves, and the fact that covering the soil causes it to produce large crops is a strong argument in favor of surface manuring. It is also an indication that the spreading of straw upon grain fields is one of the best possible uses which can be made of this material. The benefits of mulching trees have long been acknowledged. Perhaps the coming farmer will be as careful to mulch his wheat as the nurseryman of the present is to mulch his little trees. In some experiments in ENGLAND the use of one and a half tons of straw per acre spread over the land increased the grass crop to from two to three times its usual yield. Yet the climate of that country is much more moist than our own, and it is natural to suppose that the same use of straw would give our farmers still better returns. We know of no

large experiments in this line, but small ones have proved that the mere covering of the soil will largely increase the crops which it can produce.

The reason why covering the land is beneficial is two-fold. When straw or green crops are used, the plant-food which these materials contain is leached out and washed down to the roots of the plants. In this case the material not only acts as a covering for the land, but also furnishes food directly to the plants. When old boards, or any other things containing none of the elements which plants require, are used, their beneficial effect is probably due to their preventing evaporation and thus retaining the moisture and the ammonia which is in the soil. When the land is left bare for several days, as the mowing lots are after the hay crop is removed, during the hottest part of the year, evaporation goes on with great rapidity, and it is probable that large quantities of ammonia escape with the vapor which is almost constantly rising to the clouds.

We believe the subject of fertilizers to be one of the most important of all those with which the practical farmer is obliged to deal. Without fertilizers of some kind the farmer can do nothing. If he has but little manure, he will be almost certain to have a poor farm, and, if no pains are taken to increase the supply, the land will probably keep growing poorer and finally become almost, if not wholly, unproductive. But the man who labors judiciously to increase the quantity of fertilizing material for his farm will be almost sure to produce good crops and also improve his land. He certainly lays a good foundation, and upon this he can build a splendid success.

TILLAGE.

IT has long been acknowledged by the leading men who have given much thought to agricultural subjects that to a certain and considerable extent tillage is equivalent to manure. Some have gone so far as to insist that if the land were allowed to lie idle every other season, and were properly tilled, it would never need manure and would never fail to produce good crops. This we consider an extreme and unwarranted inference. It demands altogether too much of tillage—more than it can possibly supply. Even if the plan suggested would do all that is claimed for it by its advocates we do not think it would be the wisest course which could be pursued. It would involve the use of twice as much land as could be cropped, and it does not seem best for a farmer to allow half of his land to remain constantly idle. We think it is very much better to keep the soil constantly producing some valuable crop, and supply the drain which such production must make by the use of suitable fertilizers. When hoed crops are grown, these fertilizers should be supplemented by careful tillage. For, while not accepting as truth all that has been claimed for tillage, we recognize its great benefits and believe that by means of its use the crops of the average farmer can be largely and cheaply increased. We have already alluded to the fact that the soil contains the mineral elements of plant-food in rich abundance. But these elements are almost wholly locked up in the soil, and are in a condition in which plants can make no use of them. The sunshine and storms, together with chemical processes, are constantly, but very slowly, disintegrating the soil and setting these elements free. If the action of these forces were rapid enough, there would be no necessity for man to supply mineral food for his plants. The soil contains a vast, almost unlimited quantity, while the crops remove but a very little. But when left to themselves these processes go on too slowly to

furnish food enough for crops. In some way the farmer must add to, or make available, the stores of the soil. The former he can do with manure. The latter can be accomplished by tillage. The former makes a positive addition to the plant-food which the soil contains. The latter merely changes materials already in the land from an unavailable form to one in which they can be readily used. It is not best to wholly rely upon either of these methods, but both should be combined. In addition to the release of plant-food which is secured by tillage there are various good results caused by the loosening of the soil which is thereby effected. By means of tillage the land is enabled to retain a greater degree of moisture in time of drought, and the air is permitted to penetrate the soil and benefit the plants.

Of late the theory has been advanced that, instead of being beneficial, tillage is absolutely injurious to the soil. This is very strongly set forth by COL. JOHN H. McAFEE, of Mississippi, in a pamphlet, entitled, "How to Till the Soil," which has recently been published. He claims that plowing the land exposes it to a more direct action of the sun and air, and that thus its fertilizing properties are "made to escape." He affirms that plowing the land wears it out, and the oftener the owner plows it the more he exhausts the soil. In support of his theory he points to the soils which have been long cultivated and have become exhausted, and says, that if plowing was good for land, these fields would be very rich instead of almost barren. According to his theory the soil contains "just so much fertility," and frequent plowing will inevitably destroy it and leave the land barren. He lays down the broad proposition that thorough preparation of the soil before planting greatly deteriorates it, and thereby not only injures the land but diminishes the crop. It seems to us that this theory is altogether one-sided, and is not at all supported by facts. That tilling the soil exposes the land to the action of the sun and atmosphere we admit, but we do not believe that it necessitates the escape of its fertilizing

elements. On the contrary, it is *because* tillage exposes the soil to the action of the air that we advocate it so strongly. That it does not involve the loss of fertilizing elements may be inferred from the fact that the experience of many years has proved beyond all question that top-dressing is the most economical method of applying manures to grass. If manures are not injured by this exposure, the soil certainly cannot be harmed thereby. Besides, the elements which are set free in ordinary soils by tillage are principally inorganic. From the very nature of the case it is impossible that the sunlight and air should dissipate them. The only organic element in which the soil is deficient, and which can leave the land poorer by its escape, is nitrogen. That this may escape from newly plowed fields in the form of ammonia is possible. But this escape can be only in a very slight degree, and it has been proved by the researches of chemists and the experiments of farmers that newly plowed fields not only give off a little, but that they also absorb a great deal, of ammonia. Thus the soil is actually improved by culture. When the field which is to be plowed is covered with stubble, or weeds, which will decay in the soil, the amount of organic matter which it contained will be considerably increased. If the claim that plowing land "wears it" were correct, the fact would not be of great consequence, because, as we have shown, the land is full of the mineral elements of plant-food which are made ready for use as rapidly as the disintegrating process is carried on. The supply is inexhaustible, and no fear of its failure by this means need ever be entertained. Neither are the mineral elements liable to be washed away from the reach of plants. The theory that the soil contains just so much fertility and when that is gone the land is wholly and forever ruined has already been shown incorrect. Our soils were, doubtless, once ground out of solid rock by the action of immense glaciers, and they are therefore full of mineral elements. As each crop only removes a very slight quantity, there will be an abundance of

these elements even if the land is kept under constant cultivation until the end of time. The more it is worked the more plant-food is set free. There will be soil as long as the earth endures, and as long as there is soil there will be plenty of the mineral elements of plant-food.

But if this is true, how is the great fact, that hundreds of thousands of acres of land in this country—land which has only been under cultivation a very few hundred years—seem to be completely worn out, to be accounted for? The fact that these fields are exhausted is the one grand argument of the opponents of tillage, and is the one visible thing to which they refer with an appearance of being certainly correct. But in this they have jumped altogether too far and too fast in drawing their conclusions. These worn-out fields are not exhausted in the sense of containing no plant-food. Instead of having yielded up all their fertilizing material, they still contain enough to feed yearly crops for untold ages. They have not been exhausted by plowing or by any other form of culture. If nothing had been done but cultivate them, they would still retain all their original fertility. We have already referred to some worn-out fields which can be seen from our window. Looking from another window in the same room, we can get a glimpse of a large tract of land lying in a town which has been settled more than two hundred years, and land which has been yearly cropped during this long period, but which is now one of the most fertile tracts to be found East of the Mississippi. Now, if cropping and culture were inevitably destructive, this land would be worthless instead of commanding the highest price of any land in all this region.

The reason why this tract of land is so different from the other is to be found in the fact that a different system of culture has been pursued. If the facts could be obtained, it would doubtless be found that every exhausted field which has not been ruined by some great flood, or by something wholly beyond the power of man to prevent, has been brought into its present condition

by a bad system of culture which has been continued for many successive years. The elements of fertility have not been dissipated by sunshine, or scattered by tillage, but have been removed in the form of crops. Year after year crops have been grown upon the same land without manure. These crops have sought out the elements of plant-food, appropriated them, and the owner has carried them off. He has done this, too, without giving the soil the benefit of thorough tillage. Consequently, the disintegrating process has not gone on rapidly enough. It has been too slow to meet the demands of the crops. Proper culture would have hastened it to such an extent that fair crops could have been produced. Now, the plants have taken all the food they can get, and the soil must rest long enough to allow more of the elements to be unlocked from their present combinations, or else there must be the liberal use of fertilizers. If the farmer had returned the mineral elements to the soil in the form of manure, all this trouble would have been avoided. But he has been taking from the soil and giving nothing back. Virtually, he has year by year been selling his land. Every crop he has grown has carried part of it away. The farmers who have grown crops which they could feed, and who have fed them and applied the manure which they obtained to the soil, have not worn out their land. Yet their land has been tilled as long as the exhausted fields. These facts prove that it is not the tillage but the removal of crops which has absorbed the elements of fertility and impoverished the soil.

While we do not in any case favor tillage as a substitute for manure, we do most emphatically urge its employment as an auxiliary. That the tillage alone may be made thorough enough to secure the production of good crops every other year we have not the slightest doubt. On many soils, which are easily broken down, tillage may be made to produce fair crops every year. There is mineral matter enough in the soil, and matter of the right kind, to promote the growth of crops. There need be no

fears of failure in these respects. The only question is, Can the tillage be made thorough enough to supply an abundance of mineral food as fast as the crop will need it? We take it for granted that, if this could be done, the organic matter necessary would be supplied either by the air and soil, or by the owner of the land. But suppose the question to be answered in the affirmative. We still think it far better to use manure in connection with tillage, than it is to depend upon either one alone. A man *can* milk a cow with one hand, but he can do it to much better advantage by using both hands. So a farmer can grow better and more profitable crops by means of tillage in connection with manure, than he can with either one alone.

In the employment of tillage, as well as in the use of any and all means for the improvement of the soil, and the benefit of the crops, skill and judgment on the part of the cultivator are necessary in order that the highest success may be secured. We do not apprehend any injury to the land from what may be styled imperfect and injudicious tillage, but there may be a certain degree of loss to the owner of the soil. *All* injudicious labor, of whatever name or kind, involves a loss. To this rule tillage is no exception. But this fact is no more of an argument against tillage than it is against the custom of cutting grass. If grass is cut in rainy weather, the quality of the hay will be badly injured. Here the loss is caused by direct damage to the crop. When land is improperly tilled there is a direct waste, and consequent loss, of labor. If performed too late it may not bring the food, which it will be the means of providing for plants, into an assimilable condition in season to do the intended good. A farmer may be tilling his land when he ought to be cutting his hay crop, and this neglect to harvest his hay at the proper time may involve a much greater loss than he imagines. By getting over-ripe his hay will be damaged for feeding, its market price will be reduced, and the loss on this crop will far exceed the gain upon the one which is tilled. There is always time enough on a well-managed farm to give all the tillage necessary,

and the farmer should study not only the best methods, but also to avail himself of the best opportunities for doing this work.

It should also be remembered that different soils require different degrees of tillage. A loose, open gravel requires but little working compared with a stiff clay soil. If fallowing is practiced, tillage will be a great aid. Still it is not usually given. The vast majority of farmers do not sufficiently till their crops. It would be altogether too much of a strain upon faith to expect such men to till their land while it is lying idle. If they will not cultivate the soil thoroughly when it is productive, they certainly will not do much to it while it is resting. Yet some of our best farmers have found this form of tillage very profitable. Upon some of his fine wheat fields JOHN JOHNSTON does a great deal of work in the line of tillage while the land is fallow. He plows, harrows, and rolls these fields two or three times during the season. JOSEPH HARRIS declares himself unable to "dispense with summer fallowing" on heavy land, and he often uses the plow and harrow in order to unlock the treasures which his soil contains. Now if it pays to till the land while it is resting, it must be a matter of great importance to give it thorough culture while it is producing a crop. Oxygen, carbonic acid and water are the great liberators of plant-food in the soil. The more loose and open the land is kept the more readily these agents can penetrate it, and the greater the efficiency with which they will act. Stirring the soil allows their entrance, and the breaking of the clods, and mixing of the various portions of the soil which is accomplished by the use of the cultivator, will also prove of great benefit to the crop. LIEBIG, noticing the great benefits of culture, remarked that "the influence of the mechanical operations of agriculture upon the fertility of a soil, however imperfectly the earthy particles may be mixed by the process, is remarkable, and often borders upon the marvellous." This test of practical effect is the one to which every theory should be subjected.

The effect of the system upon the land and the crops should be carefully noted. If the effect is good for a reasonable length of time, it is proper to conclude that the system is correct, even though it may not be in accordance with our preconceived views or our present theories. Examining the subject of tillage in this light we find the strongest arguments in its favor. The best farmers, and the farmers who raise the best crops, practice thorough culture. The fact that they use manure freely in connection with it does not at all detract from the merits of the system of thorough tillage which we have advocated. It may be the case that certain fertilizers have been praised for what tillage has really accomplished. Manufacturers of fertilizers recommend, as they should do, careful cultivation. Now the fact cannot be denied that by means of cultivation alone some farmers have grown large crops. It is, therefore, reasonable to suppose that certain large yields of grain, which have been secured with the use of remarkably small quantities of some commercial fertilizer, have been due more to the extra culture which the plants received than they were to the manure. We are now referring only to those cases in which the reported yield is out of all proportion to the quantity and value of the fertilizer applied. When the land is highly manured, it is safe to expect large crops if the plants are well cared for. With little manure and thorough tillage large yields may sometimes be secured, but the credit is due far more to the culture than it is to the manure. The highest permanent results are only to be attained by the combined use of fertilizers and cultivation.

The best time for tilling the soil and the best methods to be employed will depend largely upon the particular crop produced, the climate, and the soil. What is a proper course to pursue with one crop may be injudicious with another, and what would be good tillage upon some soils would be so imperfect as to scarcely deserve the name if applied to others. But there are some general principles which should be constantly kept in mind.

The soil must be thoroughly fitted to receive the seed. No amount of skilful culture afterwards can atone for neglect to prepare the land before the planting is done. The seeds of farm crops are comparatively small and weak. When placed in a poorly prepared soil, which is full of lumps and clods, it takes a long while for them to get fairly started. Their small, weak rootlets cannot penetrate the clods, and it is with difficulty that they find either room or food. In all the early stages of growth the plants are placed at a great disadvantage, and are obliged to contend with difficulties which the farmer ought not to have allowed to exist. Subsequent culture may break these clods and give the plants both room and food, but it will certainly come too late to allow them to do as well as they would if everything had been favorable from the beginning. If the soil is fine when the seed is planted, growth will be prompt and regular. There will be no delay from want of food, and no time will be lost in trying to find room. The plants which start in this manner will be strong and vigorous, and will be far less likely to be attacked by disease than those which start slowly, and have a hard fight in order to obtain a hold upon life.

It is greatly for the convenience, as well as the pecuniary interest, of the farmer to have his crops grow as rapidly as possible; and for this reason, even if there were no other, good tillage should be given. If his corn comes up promptly and grows rapidly, the plants will soon be large enough to cultivate. This culture will cause them to grow still faster, and in an ordinary season, it may be possible to get the third hoeing out of the way before the haying season arrives. This is quite an object for the farmer, and the early culture will prove a great benefit to the crop. But if the corn comes up slowly, and does not grow much for two or three weeks after it does appear, weeds will endeavor to take possession of the soil, the hoeing must be put off to give time for the corn to grow, and before it has been fairly attended to once the haying needs to be com-

menced. With wheat, oats, and similar crops, the results of a slow growth during their early stages are still worse than they are with the corn crop.

The plants being weak, are destroyed in large numbers by climatic changes and insects, while the weeds, which are more hardy than the grain, take possession of altogether too much of the land. Upon most farms these crops are not hoed, and when they fail to get a good start, the weeds attain a large size, starve the grain, injure the soil, and ripen their seed. If the grain had started vigorously, it might have overcome the weeds, but starting late, and being placed at a great disadvantage, it must take the second place. It will always pay, even though it may involve some delay about planting or sowing, to get the land in the best possible condition to receive the seed. It is much better to wait a few days until the soil can be finely pulverized, than it is to hurry in the seed before the land is properly prepared. The plants will grow enough faster to more than make up for the delay, and, being much more vigorous, will produce larger crops than can be obtained if the land is not in a suitable condition when the seeding is done. While early planting is often of great importance, it cannot be more necessary than a thorough preparation of the land.

In order to secure the full measure of benefit which tillage is able to confer, it is necessary that the culture of the plants should be adapted to their particular wants. Both corn and potatoes are greatly benefited by tillage, but it must be performed in a very different manner for one of these crops than it is for the other. It is possible to injure plants by bad tillage. We have seen a corn crop seriously damaged by having too much dirt thrown upon it at once. But such facts as these are no reflection upon the benefits of tillage itself. Improper food has killed many a fine horse, but no one thinks it wrong to feed horses because some have been destroyed by bad feeding. And if a farmer has cultivated his corn in an improper manner,

and injured it by so doing, he should not lay the blame upon the tillage, but charge it to his own ignorance or carelessness.

The special wants of each particular crop should not only be studied and supplied, but it should also be remembered that, at different stages of their growth, some plants need different forms of culture. Experienced cotton-growers recommend deep culture when the crop is small, and shallow culture when it has become large enough to cover the ground. Probably the majority of corn-growers, who favor deep culture during any stage of the existence of this plant, believe it is best to cultivate shallow after the roots have reached far out between the rows. With some crops the dirt should be turned away at the first hoeings, and brought toward the plants at later ones. It may be accepted as a sound

proposition that suitable culture will not injure any of our farm crops. If crops have been injured by cultivation, it is a pretty sure proof that the method employed was defective. *In-



FIG. 10.—ANCIENT METHOD OF TILLAGE.

stead of giving up all hope from tillage, the unsuccessful farmer should study the demands of his crops more closely, and try to adapt his methods to the natural tendencies of the plants. If the right methods are adopted, tillage will give any and every farmer a great deal of efficient aid.

Another great essential to success in growing large crops by the aid of tillage is the possession and use of suitable implements with which to do the work. In the lack of these implements may be found the principal reason why so many farmers do not succeed in making what they call tillage highly successful. They have no implements which are capable of doing the required work. What they have called tillage has not been worthy of the designation. The farmers of to-day

think with pity of the ancient husbandman, whose only plow was a crooked stick, and rejoice in the advances which have been made in the construction of agricultural tools and machines. In this the average farmer does well. But he should remember that when compared with the possibilities of cultivation, of which some of the expensive machines for pulverizing the soil have given us indications, his own methods are still very rude, and there is a vast field for improvement in his own immediate neighborhood. His implements are vastly better

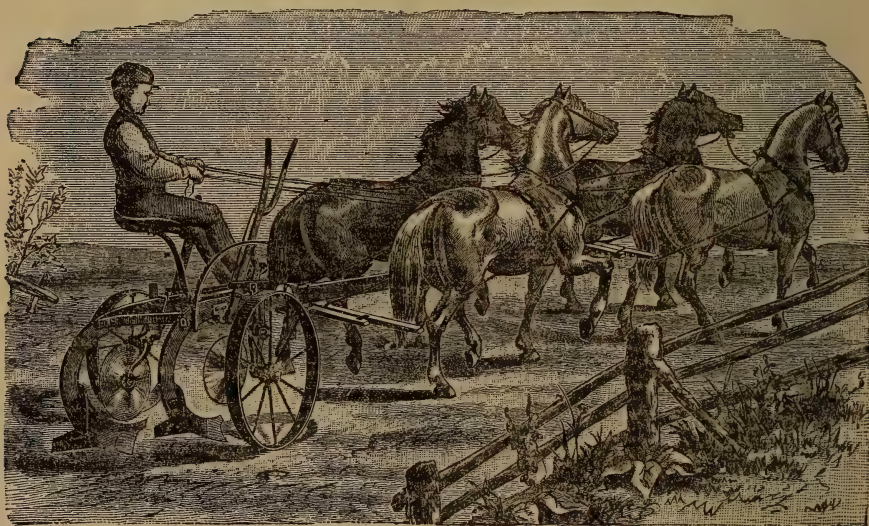


FIG. 11.—A MODERN IMPROVEMENT.

than those of his forefathers; but they are not the best in the world, and, what is much more to the case, he does not always make the best possible use of them.

The very *best* implements for pulverizing the soil are driven by steam and are too expensive for the average farmer to own, but there is no reason why he cannot have good ones with which he can work out a high degree of success. If he will obtain the best implements within his reach, and use them faithfully, he will secure the benefits of tillage in a degree which

will give him both pleasure and profit. But he must not, for a moment, suppose that the occasional use of an old and nearly worn-out cultivator, or horse-hoe, or any other implement which was never good and is not now half as effective as it was when new, is tillage, or anything closely resembling it. In order to till the soil in the way it should be tilled it is absolutely necessary to have good implements and to use them thoroughly. And until a farmer has faithfully tried it in this way he ought not to condemn tillage as a method for securing good crops. If farmers only realized the importance of this subject and would make the best possible use of the implements which they have, or which they can readily obtain, we are confident that they would largely increase the yield of their crops and make their business much more profitable than it has ever been in the past.

The accompanying illustrations show the difference between ancient and modern methods of tillage. Figure 10 represents the plow and team used by the Egyptians in the olden time. Figure 11 exhibits a Western team attached to one of the Furst & Bradley "Garden City" gang-plows.

THE CHOICE OF CROPS.

THERE are few things of a purely intellectual nature which do so much toward determining whether the farmer shall succeed or fail in his business, or which are so influential in fixing the degree of success or failure, as the choice of the crops which he will produce. Though success in farming depends upon a great many different things, and cannot be secured by the most careful attention to any one or two of the items if the others are neglected, yet there are certain foundation principles which must be observed or failure will be certain and absolute. Neglect of some points will diminish the profits of the business, while if others are disregarded no profits can be secured. The choice of crops is one of the essentials.

A mistake here is radical and may be fatal to success. No amount of diligence in business, and no quantity or degree of skilful culture can atone for an error in this department of the work of the farm. The choice of crops is to the farmer what the selection of goods is to the merchant. Every one knows that if a merchant is to succeed he must keep a stock of goods of the kind and quality which his customers want. If he lays in a stock of silk when his customers want calico, or chocolate when they want coffee, he will not be able to sell his goods, those who have been his patrons will go to other stores where their wants can be supplied, and the merchant, having lost his trade, will be obliged to shut up his store. If a merchant cannot, or will not, supply the wants of his customers, he must expect to lose their trade. If a man wants a certain class of goods he will not long remain satisfied to take a different kind simply because the merchant with whom he has traded is out of what he needs and has a surplus of what he does not want. Now this same principle, which is so clear in its application to the merchant, is of equal importance to the farmer. Both merchant and farmer depend for their living upon the sale of articles. The former obtains the goods which he sells, by purchase. The latter secures his as the result of labor and skill in the cultivation of the soil. The one must buy what he can sell or he will not succeed. The other must produce what he can sell or he will certainly fail. It requires some skill in a merchant to determine just what goods, and what particular grades his customers will want. The farmer needs an equal degree of skill to enable him to supply the popular demand for his productions. The market for the farmer's products fluctuates in its special demands almost as much as that for the products of the manufacturer's skill. The fact that a certain kind, or quality, of farm products is popular just now is not the slightest indication that the popularity will be permanent. The farmer must not go on year after year growing something which was in style twenty

years ago, and paying no regard to the present demands of customers.

A few years ago the local dealers in pork, in this vicinity, wanted large and heavy hogs. Now they do not want the weight to exceed two or three hundred pounds. The producers who have changed their methods of feeding, so as to supply the demand, can sell readily and obtain the highest market rates. But the few who have paid no attention to the change in the wants of customers often have hard work to dispose of their products, and frequently are obliged to sell for less than the ruling price, because their hogs are heavier than the buyers want. When we commenced growing onions for the market, we produced about equal quantities of the red and yellow varieties. We had been told that the red ones would sell the best, but that the yellow ones would ripen soonest. But we soon found that our customers much preferred the yellow ones—that we could sell these without difficulty, while very few wanted the red ones. Consequently we gave up growing red onions and cultivate the yellow variety exclusively. Whether the yellow ones are better than the red ones we cannot say. It is a question for our customers to decide. We care nothing about it either way. The kind which will sell is the kind which we shall grow, and as long as our customers demand one particular kind we shall not trouble our mind with the question whether it is better or worse than some other sort. This is the principle which must govern the farmer who is to be successful. He may believe that the Snowflake potatoes are far superior to the Early Rose, but if buyers want Early Rose and do not want the Snowflake, it is useless for him to insist upon growing the best ones simply because they are better than the others. The consumers are the ones to judge of the quality, and it is safe for the farmer to rely upon their choice. The farmer may also believe that it is a great deal better for people to eat mutton than it is to use pork; but if the people who do the buying want the pork and will not

eat the mutton, the producer should waste no time in trying to force buyers to take the meat which they do not want. If buyers pay their money, it is but just and right that they should take their choice.

Like all other principles this is liable to abuse. It may be carried too far. We strongly recommend it so far, but only so far, as it can be followed in perfect honesty, and without encouraging an evil course on the part of buyers. When moral principles become involved, the *right*, and not the popular demand, should be the standard of choice. We would never convert cider into brandy because a customer preferred the brandy to vinegar. Neither would we allow our grain to be converted into whiskey because a buyer preferred the whiskey to flour or meal. But within certain well-defined and easily described limits it is not only wise, but is very important that the farmer should grow those crops which will supply the popular demand. No evil habits should be encouraged and no vitiated tastes should be gratified. But in all questions such as the particular variety of potatoes, or onions, or apples, the choice of pork, or beef, or mutton, the growth of corn, or wheat, or oats, the wants of the consumers should be the court of final resort. As far as himself and his family are concerned the farmer may profitably grow the particular crops and varieties which they consider the best, but for market these preferences should be waived, and those of his customers be allowed to govern his choice.

In order to aid him in making a proper selection of crops the farmer should keep himself constantly informed concerning the state of the markets in which he deals. He should note not only the prices which are paid, but also the tendencies of these markets. It sometimes happens that a demand for a certain kind of vegetable, or fruit, will commence on a very small scale and gradually increase to large proportions. The farmer who sees the opportunity at the beginning, and improves it, may thus

add a very profitable item to his business. Still, care must be taken not to over-do the production of any article which is just becoming popular. There will be a limit to the demand, and no one can tell how soon it will be reached. The men who start first in the matter will secure and can retain customers, but those who begin when the market is full will have great difficulty in disposing of their products. The pop-corn business in some of our large cities furnishes a fine illustration of this principle. The production of fine crab-apples is another line in which the early and skilful producers are highly successful. The man who is ready to supply the demand for such articles as soon as it arises does well, but it often happens that those who go into the business after the supply equals the demand are losers thereby. Any business of this kind should be commenced on a small scale, and increased only as the state of the market demands. There should be no giving up of standard crops on account of "great expectations" from new ones.

A merely temporary demand, which is caused by some unusual occurrence, must not be construed as an indication of a permanent change. If the potato crop is a partial failure, and prices reach an extreme figure, many families will buy turnips instead of potatoes. This will cause an unusual call for turnips, and prices can be obtained which will make them a profitable crop. But from this fact it will not be safe to expect high prices for turnips to rule permanently. Just as soon as potatoes are plenty, the families who substituted turnips because they were cheaper will give them up, and go to using potatoes. There are many farm products which will always sell to a limited extent which, in time of the scarcity of some prominent crop, may be used as a substitute therefor, and thus temporarily be in great demand, but which, from the very nature of the case, can never be extensively used or sold. To force the production of such crops is worse than useless. It will involve a loss on the part of farmers with no corresponding gain to

any one else. The wise farmer will not enter upon their cultivation on a large scale until he is satisfied that there will be a local demand, the supply of which he can in some measure control, and that the call is not merely temporary, to serve some incidental purpose, but will be steady and permanent. It is very much better for a farmer never to vary his round of crops in the least than it is to be constantly changing from one to another, and trying every new plant which makes its appearance.

We have alluded to the fact that the farmer and the merchant are both interested in supplying the popular demand for the various articles in which they deal. In disposing of their goods both parties stand on equal terms. But in obtaining them the farmer finds himself at a great disadvantage. The merchant can go into the wholesale markets and buy just what he wants. He can obtain one class of goods just as easily as another. If his customers want cotton-cloth, he can get it without trouble or delay. If they prefer the finest silks, he can get them just as well. But with the farmer the case is different. He finds himself under certain limitations. Instead of going to some wholesale market, and calling for anything which he wants with the certainty of obtaining it at once, he must go to the soil, and determine by a practical trial whether the required crop can be produced. Many farms have been badly cultivated, and thus rendered incapable of producing certain crops. There are many sections in which the land is specially adapted to the growth of some plants, and entirely unsuited to the production of others. Therefore, in making his choice of crops, the wise farmer will not only take into consideration the wants of his customers, and the tendencies of the market, but also the character of his land, and its adaptation to the growth of particular plants. If his land is not all adapted to the production of wheat, he will grow some other crop even when wheat is selling for a high price, and there is a great demand. The farmer

whose land is light and warm should choose crops which are adapted to that kind of soil, while the one whose land is heavy, and inclined to be wet, should grow an entirely different class of plants, or else thoroughly drain his land, and cultivate it in ridges so as to almost wholly change its nature and condition. Aside from these natural characteristics of the land, there will be found a great difference in the quality of the plant-food which soils contain, and thus their adaptation to special crops will be greatly modified. If a soil is naturally, or by a bad system of cultivation has become, deficient in potash, it will not be adapted to those crops which require a large proportion of this element. If it has become deficient in silicic acid, it will not be adapted to the production of wheat or rye. If phosphoric acid is deficient, it will produce none of the grain crops to good advantage. The same principle applies to a deficiency of all the other elements. The crops should be so chosen that they shall require only in a very slight degree the elements in which the soil is deficient. This, for farmers whose land has long been cultivated, is a severe limitation, and if there were no way in which it could be safely modified, would permit the growth of but very few kinds of plants.

Fortunately, by the use of fertilizers, it is possible to supply deficiencies which may exist in the land, and thus prepare it to produce crops for which it is not naturally adapted. Where only barn-yard-manure is used, the special adaptations of the land will stand out with considerable prominence. This manure, when it has not been damaged, is a complete fertilizer, and, to some extent, supplies all the elements which plants need. But if a soil is deficient in potash, and a crop is grown which needs a liberal supply of this element, the yield will be measured very closely by the amount of potash contained in the manure. If the same crop is grown upon equally good land which also contains an abundance of potash, and is manured the same as the other field, the yield will be greatly increased. The same is

true in regard to each of the other elements. When no fertilizer is used, and when only barn-yard-manure is applied, the yield will be greatly influenced by the degree of the adaptation of the land for the particular crop under cultivation. Consequently, it is a matter of great importance for the farmer who relies upon farm manures to make a wise selection of crops. While it is necessary that he should choose some crops which he can either use or sell, it is also necessary that he should select those which he can grow. No matter how well a crop will sell, if a fair yield cannot be secured there should be no further efforts to grow it, but the farmer should turn his attention to something which he can produce. Farmers need more individuality. As a rule, in wheat-growing towns all the farmers raise wheat, in corn-growing sections all produce corn, and whatever other crop may be the leading one in other places the farmers all grow it, and do not stop to think whether it would pay better to grow some other crop. It may happen in a wheat country that there will be a few farms which, on account of a peculiar formation of the soil, or by reason of bad management, are not so well adapted to wheat as they are to some other product. The owners of such farms ought to recognize this fact, and choose their crops with reference to it. Independent thought, aided by careful experiment, would be a great help to a multitude of farmers who have got into the ruts.

It sometimes happens that the crops which the land is best fitted to produce are not the ones which will find a ready market, or which the farmer prefers to grow. In such cases the fertilizers for special crops may prove of great value, and enable the farmer to obtain a good yield of the crop which he wants to produce. We have no doubt that land which is not very well adapted to onions may be made quite productive by the use of a good fertilizer made for this special crop. In all cases it is better that the land should be naturally favorable to the crop to be grown, but it often pays to use manure which supplies just what the

plants want, and thus, practically, fit the land to the crop instead of choosing the crop with reference to the capacity of the land. A farmer may be so situated that he could make his business very profitable if he could grow potatoes, but finds that his land has been so nearly exhausted that it will not produce a paying crop. He may not be able to obtain large quantities of manure, and by its use improve the soil, or he may not wish to incur the trouble and expense which such a course would involve. But if he will use a liberal quantity of a good potato fertilizer he can secure paying crops, and not make his land poorer by their removal. The discovery of special manures removed one of the greatest restrictions from which farmers had suffered. Until they came into use there was, in many places, but little liberty about the choice of crops. Now, with skilful management, crops can be grown where they would not have succeeded under the old methods of culture.

Another point to be considered in choosing crops is the cost of production, and its proportion to the value of what is secured. A neighbor recently said that the potatoes which he grew last year cost him a dollar a bushel. He could have bought nice potatoes for less than half what it cost him to grow them. Many a crop has cost the grower much more than it was worth. It is one thing to secure a good yield, and quite another thing to make the crop *pay*. And this fact must be kept in mind when an effort is made to grow certain crops on land not specially adapted to their production. It is not an object for the farmer to grow large crops, or crops which will sell readily, if the cost exceeds their value. But with careful management we think that almost any crop may be grown upon land which is not decidedly unfitted for it, and be made to pay. We *know* that by the use of suitable fertilizers, by thorough preparation of the land, and careful cultivation of the growing plants, the natural inadaptation of some soils to certain crops can be overcome, and money can be made in their production. An accu-

rate account should be kept with each and every crop which the farmer grows, so that he can be sure which crops pay him the best and which are unprofitable. The cost of fertilizers, expense of culture, harvesting, and marketing, should all be noted. If the crop is sold, its value can be easily ascertained, and a balance can be struck which will show the amount of the profit or loss. If the crop is to be consumed at home, its value should be carefully estimated, taking the ruling cash price as a standard.

The principal crops which are grown upon a farm should be those which can be used at home if there is no demand for them in market. Many farmers have been brought into financial difficulties by their neglect of this principle. Men who have made tobacco their standard crop have often been obliged to make great sacrifices which might have been avoided if, instead of devoting all their energies to this, to them, useless plant, they had attempted to grow it only upon a small area and had obtained hay and grain from the remainder of their land. When tobacco sold well, these farmers had but little trouble. They took the money obtained for their tobacco and bought family supplies, grain for their teams, and hay for their stock. But when there was no sale for tobacco, and farmers had to keep what they had grown until it was two or three years old, those who had no other crop were very badly off. They could not make the tobacco available. It would neither supply the wants of their families nor feed their cattle. These farmers had often said that it did not pay to grow corn, but they found that a few of their neighbors who had held to the old-fashioned crops were much better off than themselves. It is always safe to grow corn, and oats, and grass, for if there is no sale for them they can be largely, and as a general thing profitably, used on the farm. When wheat is plenty it will sell for something, and for use as food it is just as necessary to the family as it ever was. A crop which can be either used or sold is always far preferable

to one which cannot be used and which does not at all times find a ready sale.

If these principles are followed, the farmer can determine which are the best crops for him to produce. The knowledge thus obtained will prove of great benefit. It will give him the advantage of working in the light. It will take him out of the realm of guess-work and teach him to rely upon facts and figures. It will enable him to select his crops with reference to the capacities of his land, or, when it will be more profitable for him to do so, to adapt his land to the crops which he wishes to produce. If he makes a wise choice of crops, he thereby takes a step in the straight road which leads to success. Having started right, he can, by high manuring and thorough culture, obtain large yields and secure a large percentage of profit. The experience of past generations has taught that the choice of crops is one of the main dividing lines between success and failure on the farm, and that wisdom requires the farmer to give this subject his earnest attention.

ROTATION OF CROPS.

IT is not only necessary that the farmer should make a wise choice of the crops which he will produce, but it is also important that he should follow a system of rotation. It is for want of such a system that many fields are now unproductive. The one crop method has been pursued until the crops have failed to pay the cost of production. A suitable system of rotation would have long deferred the time of exhaustion. In connection with the use of fertilizers it would have prevented any and all injury to the soil. Nature follows a course of rotation. When an oak forest dies, or is cut off by man, other varieties of trees spring up, and instead of another oak grove the owner of the land will find pine, and chestnut, or some other trees which are very much unlike the original oak.

From this fact we may draw the inference that an occasional change of crops is demanded by the soil. Experiments have proved this inference correct. It was once thought that plants were in the habit of throwing off their waste substances, and that these poisoned the soil for all plants of a similar nature, but left it uninjured for those of a different class. This theory has been generally abandoned, and there is but very little evidence by which it can be sustained. The opinion now held is that different crops take the elements of plant-food from the soil in different proportions, and that this fact accounts for the great benefits resulting from a change of crops.

It is true that some crops require more of some elements and less of others than certain plants which are differently constituted, but this explanation does not seem to cover all the ground. Each of our leading farm crops takes nitrogen, phosphoric acid, and potash from the soil. None of them can be produced without a supply of all three of these elements. It has been proved that land will produce wheat, corn, and oats in succession much better than it will three successive crops of wheat. But the difference in the demands for plant-food can hardly account for all the difference which is manifested in the crops. It has something to do with it, but probably is not the only reason. When a crop which makes a large use of potash is followed by one which requires but little of this element it is easy to see why the change should be beneficial. The former crop used the potash as fast as it could get it, and if planted the next year would need a larger quantity than the land could supply. But with the other crop the changes going on in the soil will set free as much potash as is required. For this crop there is plenty of potash, and a surplus may be left in the soil for future crops. But this principle is not of very extensive application to our leading crops, because they all require considerable quantities of each of the elements of plant-food in which soils are likely to be deficient.

Probably one of the reasons why a rotation of crops is so useful may be found in the fact that some plants are much more delicate feeders than others. The wheat plant is not able to take as large a proportion of the plant-food which the soil contains as rye and oats. Consequently, either rye or oats will follow wheat to much better advantage, as far as the yield of the crop is concerned, than two successive crops of wheat can be grown. Another reason why a change often proves beneficial is to be found in the fact that some crops demand, and receive, a great deal of cultivation, which allows the air to penetrate the soil and hastens the liberation of plant-food, while others admit of little or no culture after the seed is sown. Still another reason may be found in the fact that while some crops, like corn, are almost wholly removed from the land upon which they have grown, others, like oats, are partially left, in the form of stubble, and furnish considerable organic matter to the soil. This does something to prevent the great waste of nitrogen which results when both grain and stalks are wholly removed. A directly opposite reason may sometimes be the one which renders a rotation of crops beneficial. Upon very rich clover fields this crop sometimes fails to do well. This is not at all because the land is exhausted of the elements which clover needs, but because successive crops of clover have left such large quantities of vegetable matter in the soil that the land is overloaded with this material in all stages of decomposition. To a certain extent it is of great value, but in order to be useful it must first be decomposed. When rich lands are kept long in clover this organic matter accumulates faster than it can be used, and fills the soil with fermenting substances to such an extent as to make it sour and unproductive. But if the land is plowed, this organic matter will be rapidly decomposed and will furnish valuable food for plants. That which on account of its great abundance was an evil in the land devoted to clover will prove a splendid fertilizer for the corn crop. After the land has been

plowed a few times, and thus exposed to the action of the air, it can again be made to produce fine crops of clover.

These we consider the principal reasons why a rotation of crops is so useful to the farmer. Whether they cover the whole ground or not, we think they account for most of the changes which take place under such a system. And the fact remains that a wise rotation proves of great utility. Whether the methods in which it operates can be explained or not, the fact that it is a help to the farmer is too evident to be doubted, and the wise farmer will accept and act upon it without requiring a perfect description of the manner of its working.

In choosing the crops which he will grow in the successive seasons occupied by the rotation, the principles stated in our consideration of the subject of the choice of crops should be applied. Four or five of the best crops should be selected, and the land devoted to each in its regular order. Grass should be one of the leading crops in every system of rotation. This may be followed by corn. The next year the land may be devoted to potatoes, or carrots, turnips, or sugar-beets. The next season green forage crops, principally oats and corn, may be grown, and winter rye sowed in the fall. The next year this rye may be cut while green, for fodder, and other forage crops be grown upon the land which is earliest cleared. In the fall of this year wheat should be sown, and the land seeded with timothy and clover. The next season the grain is harvested and the grass is allowed to remain. To each of these crops a liberal quantity of manure is to be applied, and the year after the seeding is done the land will produce two heavy crops of grass. This is the rotation, with a very slight modification, which is followed by MR. WARING, at OGDEN FARM. We pay less attention to roots and to green forage crops. In the Northern and Middle States grass followed by corn, than a green fodder crop, then wheat, then grass again, would be a good rotation. We have often grown corn two years in succession, and, when the

turf is very heavy, we consider it a good method, provided a sufficient quantity of manure is applied. Instead of the corn, potatoes, or green fodder, may be grown to good advantage upon an ordinary sod. Oats or rye may sometimes take the place of the green crops during the second year. But with the exception of corn (which will bear successive planting on the same land better because it is cultivated and hoed), two grain crops which are allowed to ripen their seed should not be grown in succession.

There are locations in which a very different system of rotation will be necessary to make farming successful. Each farmer must judge for himself. Upon the principles already suggested, he should make a choice of crops and then arrange to produce them regularly, but upon different fields, each year. The rotation should be for the purpose of preventing injury to the land, but the farmer should not allow this idea to lead him to grow crops which will not pay. There are crops which will pay, and with which a rotation can be formed. Their selection will be more difficult in some places than others, but is not impossible in any good farming country. At the South, owing to the difference in its climate and soil, different crops can be produced from those which do well at the North. It is also true that what would be a good rotation upon soils of a limestone formation will not be the best for sand or clay. For the worn soils at the South, PROF. PENDLETON recommends cotton for two years, followed by corn on the most productive portions and wheat, or oats, on the rolling lands, while during the fourth year the land should lie fallow. He claims that upon land not very deficient in vegetable matter the cotton will give better returns if grown two years in succession than can be obtained if another crop intervenes. Where the land has not been badly worn the fallow is not necessary, but it is strongly favored by the best practical farmers at the South for all exhausted soils. It is, probably, more necessary there than at the North. In the

latter section the land is covered for some time during the winter, and the freezing and thawing to which it is subjected proves very beneficial. Then it is not exposed to such intense and long-continued heat in summer as the Southern soils. Besides, where cotton is grown, the elements of fertility are rapidly removed with the crops. An ordinary crop of cotton, including seed and stalks, takes from the soil more than three times as much of each of the leading elements, nitrogen, phosphoric acid, and potash, as an average crop of corn grown upon the same land. As these lands have not always been well manured, and have been kept closely in cotton, it is easy to see why they have become exhausted. We think that by the use of green crops, together with manures, these worn soils can be so restored that they will produce a suitable rotation of crops without requiring a year of absolute rest.

We are confident that grass should be made one of the prominent crops in all systems of rotation. Almost all soils seem to have a natural adaptation to this crop, it is a product which can be used on all farms, and in almost all sections the surplus can be sold; it is not an exhausting crop in itself, and it gives a good start to the crop which follows it. We have already alluded to the value of sod as a fertilizer. It can often be made an economical manure, and may be used quite freely in a system of rotation. In many cases it would pay to follow grass with corn, manuring the land well for this crop, and then apply a special fertilizer and sow wheat. With the wheat a liberal quantity of grass and clover seed should be used. The next season the wheat should be harvested, but the grass should be allowed to remain and cover the soil during the winter. The following season two large crops of grass may be removed, and the next year the same rotation can be again commenced. With high manuring we are confident that this plan would give large crops and pay at least twice the profit which the ordinary method of culture returns.

Upon farms on which the live-stock interest is prominent, pasturage may profitably form part of a system of rotation. There are many farms upon which this is now practiced, but on the great majority nothing of the kind is attempted. The pasture, as a general thing, consists of the poorest land of the farm. This land is never plowed or manured. Some farmers improve upon this method by occasionally applying bone-dust or some other fertilizer. There are a comparatively few others who sometimes fence a small piece of land from their pastures, plow it, and by manuring and seeding get it into a much better quality of grass and also secure a much larger quantity than was before obtained. Then there are a very few farmers whose pasture lands and mowing lots are interchangeable. They sometimes use one field for the pasture for a few years and then plow and plant it, while they keep their cattle in what has been one of the tillage fields. This, where it can be pursued, is altogether the best course. It will tend to keep the land productive without involving very heavy expenses. But there are many pastures with which such a course is not practicable. Before they can be brought under profitable cultivation the land must be drained, cleared of stumps or stones, bushes must be cut, and quite a large amount of work in the way of reclamation must be done. In many cases it would pay well to do this. In others, such a course will not be advisable until the financial condition of the owner is greatly improved. There are other cases in which it would pay well to add to the pasture a few acres of what is now tillage land, which can be occasionally fenced out and reseeded. There will be plenty of tillage land left—all that the owner can profitably manage—and the course proposed will greatly increase the value of the pasture.

There is little danger that the advantages of a system of rotation of crops will be overestimated when the system is properly followed. It will not do to expect everything of this, or of any other single method of farm management. If a rotation of crops

is attempted without manure the results will not be as good as ought to be secured. Crops cannot be grown without either being manured or else injuring the land. The effort to grow them without supplying plant-food is worse than useless. Whatever measure of success may be secured is obtained at the cost of direct injury to the land. Rotation with manure is a great help to the farmer. Without manure it merely puts off the evil day when the land shall be ruined, but it has no power to prevent the coming of the time when crops will fail and the soil will be exhausted.

MONEY CROPS.

HILE it is important that the farmer should produce as large a proportion as possible of the articles which are always needed in the family, and which must be obtained either at home or abroad, it will also be necessary for him to grow some crop, or manufacture some article which can readily be converted into cash. For, with the most skilful management, the farmer will find that there are many expenses which must be met with money. These expenses cannot be avoided, and no method of exchange can be made to meet them. The less the skill which the farmer has, the larger will be the amount of these expenses. It should be one of the first studies of the farmer to avoid the payment of money just as far as possible, and still be honest toward all with whom he deals. This effort should not be made in the line of crowding down the prices of goods which he must buy, or of withholding any payment which has been or may be promised, or by requiring the family to do without things which are necessary to their comfort and happiness. For whatever he buys, the farmer should be willing to pay a fair price. He wants to get such a price for his own products. Consequently he should be willing to allow it to others when he buys of them. Whatever

he buys he should pay for, and he should be willing to provide all that he is able to for the comfort of his family. The secret of success in accomplishing these purposes is not, as many seem to suppose, comprised in the one idea of a strict economy. It is true that economy must be practised. There must be no waste, for waste is always ruinous. But economy is only one of the incidentals. Some men have practised this virtue to a grinding extent, and yet not got along well in the world. Economy is necessary, but with nothing else to help him the farmer is as badly off as an engine without fire or water. He must practice economy, produce all that he can at home, and, as far as possible, exchange his surplus articles for those which he is obliged to buy. Both of these principles will be considered in their appropriate places. By closely following them the farmer will be enabled to keep the cash expenses of his business down to the lowest possible point. But when this has been faithfully done, he will find that there are many calls for money—calls which it is absolutely necessary that he should promptly meet. Taxes must be paid in money, and every farmer must pay them. The cost of sustaining Churches and Sunday-schools should be cheerfully met. Doctors' bills, medicines, clothes, books, papers, and many other things which are required, must be partially or wholly paid in cash. To meet these inevitable expenses, the farmer should grow some special crop. What this shall be must depend largely upon the soil, but in a still greater degree upon the demands of the market in which it is to be sold. Sometimes in addition to a particular crop the surplus of other crops may be used for this purpose, or some manufactured product, like butter or cheese, may be employed. Some farmers grow onions for a money crop. Others sell hay. Others make a specialty of butter. The Southern farmer sells cotton, while the Western farmer produces beef. Many farmers sell wool and make money, even at the present low prices. Some rely upon fruit, but this is a somewhat uncertain crop. In

some localities it fails regularly every other year. Consequently it is not a good crop upon which to rely.

While it is impossible to say which specific crop it will be best for any farmer to grow, without knowing the demands of his markets, and the condition of his soil, there are a few principles which may be laid down which it will be safe to follow.

The crop should be one to which the land is reasonably well adapted—something which can be grown without a great outlay for fitting the soil to the wants of the crop.

It must be a crop the culture of which the farmer understands, or can readily learn.

If possible, a crop should be selected which can be produced in connection with the ordinary farm crops, and which will not require an outlay for extra help.

A crop should be selected which will not require the purchase of expensive machines, or the erection of costly buildings for its culture and curing. The exceptions to this rule are few, and to be found in the cases of farmers who have capital which they can invest in this way without embarrassing their ordinary farm operations.

The crop grown for this purpose should be one which is very sure to succeed. There are several crops which are so well suited to the soil and climate, and can so readily adapt themselves to any variations which may take place, that when they are properly managed a failure is almost impossible. Therefore there is no excuse for the farmer who relies for his money upon a tender and uncertain crop.

Finally, the crop selected for this purpose must be one for which there is a ready sale, in convenient markets, for cash. There are standard products which will always command money. They may sell low sometimes, but they will sell for something approaching their real value. These are the articles for the farmer to produce.

If the farmer follows these principles, secures regular customers and deals fairly with them, and produces a good grade of the articles which he wishes to sell, he can invariably succeed in obtaining money enough to meet all of his current expenses.

FARM AND FODDER CROPS.

FOR the sake of convenience we will divide these crops into four classes, and consider those of each class in their alphabetical order. These classes are crops for sowing, for planting, for forage, and root crops. Though somewhat imperfect, it is believed to be the best classification which can readily be made. The class of sowed crops is quite large and embraces some of the finest crops in the world. It includes those which are of special value as food for man. The second class also includes many extremely useful crops, but several of the number are useful as luxuries rather than necessities to man, and quite a number are principally used as food for animals rather than for the human race. The third class is cultivated for animals exclusively, while the fourth is used as food for both man and beast.

BARLEY.—In EUROPE this is a very important crop, and in some parts of this country it is coming into common use. It is a nutritive grain, though considerably inferior to wheat. In EUROPE it is largely used for bread. Here it is grown for animals and also for the manufacture of beer. For the latter purpose it should never be grown. We are convinced that the world would be much better off if none were produced than it is under the abuse to which the grain is subjected by the liquor-makers. Though subject to several diseases, this is, in some respects, a very hardy plant, and readily adapts itself to all varieties of climate and to various grades of soil. There are two leading varieties of barley—the two-rowed and the six-rowed. There are also several sub-varieties which are the result

of the modifying influences of soil, climate, and different styles of cultivation. It is an annual plant, but some of the sub-varieties have been so modified that they are treated as winter grain. If sowed in the spring, the seed should be got in quite early. More than most grains the seed of barley rapidly deteriorates under careless cultivation. Consequently, it is necessary to use special care in saving seed or else to frequently purchase a stock from a different section of the country. A medium soil, neither heavy nor light, is best adapted to this crop. Wet land should be thoroughly drained before devoting it to barley. It may be sowed on an inverted sod, or follow a hoed crop, but should not follow wheat or rye, and two crops of barley should not be grown in succession on the same land. Two bushels of seed per acre for poor land and three for rich soils is considered the best rate of seeding, though some farmers recommend using only from one and a half to two and a half bushels, according to the strength of the soil.

The harvesting should be done as soon as the grain is fully matured. It should be carefully dried in order to prevent heating in the mow. The grain may be profitably used for fattening swine. It is deficient in gluten, but contains a large percentage of starch. The straw is hard and of small value for stock food. While it does very well in many localities, we think that as a grain for universal cultivation barley falls far below many other varieties.

BUCKWHEAT.—This plant has been known for ages and cultivated in a large part of the civilized world. In some respects it is a very peculiar grain. While nearly all the plants grown for food require a thorough preparation of the soil and a mellow seed bed, this grain seems to have the power to fasten itself upon the hardest, toughest soils and reduce their surface to a fine powder. On this account it is often used to subdue wild land. The sod is turned as well as possible and buckwheat is sowed. In the autumn, when the grain is removed, the surface

of the land will be found very mellow. We have seen a tough, sedgy field thoroughly subdued by one crop of this grain. Two crops in succession would probably reduce any ordinary sedge. The plant will grow on very poor land, and is often used as green manure on soils which are too poor to give a strong growth of clover. On rich land clover is to be preferred, but for poor soils buckwheat is one of the very best fertilizers known. It is quite valuable for manuring land for rye. For this purpose it should be sown about the middle of July. It will then be ready to turn under about the tenth of September. When the grain is to be saved, the sowing should be performed in June in the NORTHERN STATES and July or August in the SOUTH.

There is only one distinct variety in general cultivation. From one-half bushel to a bushel and a quarter of seed may be sown per acre. Some growers who make a specialty of the grain use only one peck of seed per acre. It is usually sown broadcast and harrowed in. It ripens very unevenly. The harvesting should be done when the seeds from the first flowers are fully ripe. If allowed to remain without cutting, the plant will keep blossoming all the season, but the earliest seed will shell out and be wasted. It should be cut when the dew is on in order to prevent shelling. Some farmers do not bind this grain, but set it up in small stooks, giving the heads a little twist to keep them together. As soon as dry it should be drawn to the barn and threshed. It is always best to gather this crop before a frost. If well cured, the straw is said to be good fodder for sheep and cattle. When thrown upon the land, or in the yards, it decays rapidly and is valuable for manure. The grain makes a fair-looking and nutritious flour, which is in great demand for making cakes. In some parts of EUROPE it is mixed with wheat and made into bread. It is a valuable grain for poultry, and when mixed with corn is excellent for swine.

Many farmers consider this a very exhausting crop. It is

almost impossible to grow corn on land which produced buckwheat the preceding year, and some farmers claim that grass land is injured by growing an occasional crop of this grain. We have seen some very good land apparently injured by a single crop of buckwheat. The analyses of the crop which we have been able to obtain do not indicate anything very exhausting in its nature. It requires considerable potash, but not an excessive amount of either nitrogen or phosphoric acid. Some growers assert that buckwheat "poisons" the soil. But this does not seem to be a reasonable conclusion. Although this crop is considered so damaging to the land, we have seen it growing on miserably poor sandy plains, which would not produce corn or wheat, but which gave a fair yield of buckwheat. Not only this, but on these poor soils buckwheat can be grown year after year, for many years in succession, without seriously diminishing the yield. That land which will not grow one crop of corn without manure will produce several crops of buckwheat seems very strange, but there is abundant evidence that this is the case. After the soil has long been devoted to buckwheat it will not readily be made to produce other crops.

As an aid in reclaiming waste land, for growing on sandy plains, and as an occasional crop on the better kinds of land, buckwheat may be grown in small quantities, but we do not believe its production on an extensive scale would be profitable to the ordinary farmer. Whenever it is grown, the land should receive an application of well-rotted compost, chemical fertilizers, or wood-ashes. It should not be grown without the use of something in the line of plant-food.

FLAX.—This plant was known, and in quite common use, in the early ages of the world. Until cotton largely took its place it was one of the standard crops with the AMERICAN farmer. He used to grow the crop, dress out the fibre, and his wife, or some woman in the neighborhood, would weave it into cloth. Under the old system the cultivation of this crop involved a

great deal of very unpleasant labor. Within the past twenty years machines have been introduced which now perform some of the hardest of the work.

The plant succeeds well throughout the country, but needs a good soil in order to yield large crops. Fresh manure should not be directly applied, but the land may be made rich during the year preceding the growth of the flax. Salt and ashes are both good fertilizers to apply when the seed is sown, and plaster may be sprinkled over the plants when they have nearly attained their growth. The land should be deeply plowed, and if inclined to be wet, thorough drainage should be secured. The harrowing should be very thorough so as to leave the surface soil quite fine and level. This should be done early in the season, and the land allowed to lay a week or two in order to give the weed seeds which are in the soil an opportunity to germinate. At the end of this period another thorough harrowing should be given. This will destroy the weeds and fit the land for the reception of the seed. When the soil is reasonably dry and warm, as it will be by this time if the operations were commenced when they should have been, the seed may be sown and covered with a brush-harrow. Some farmers use a light-hand implement of this description, and do not allow a team on the field after the seed has been sown. The quantity of seed to be used will depend upon the purpose for which the crop is grown. If wanted for the seed, from half a bushel to a bushel per acre may be sown; but if for the fibre, at least a bushel and a-half of seed should be used. When but little seed is used, the plants send out large branches, which will produce many seed-bolls, but the fibre will not be first rate. Thick sowing secures a large number of plants, which grow straight and tall and furnish a large quantity of the best quality of fibre, with but comparatively little seed. When the plants are a few inches high, the weeds which have appeared must be carefully pulled by hand. The men or boys who do the weeding should go barefoot in order to prevent injury to the crop.

The old method of harvesting flax was to pull it by hand. This was a very laborious operation, and required a great deal of time for its performance. At present reapers are frequently used. Machines for pulling flax have also been devised. When the growth of the crop is uniform, they work pretty well. Many farmers use the common grain cradle, some prefer a scythe, while a few still adhere to the old method and gather the crop by hand. If cutting is attempted, it should be done as close to the ground as possible. If the flax is pulled, the dirt should be shaken from the roots. The time for gathering this crop is when the bolls have turned brown, the lower leaves died, and the stems changed to a light yellow color. If pulled or cradled, the flax may either be bound at once or dried in the sun. If bound before being dried, it must stand some weeks in stooks before it can be safely put into a large stack. If cut with a scythe, the flax may be treated the same as hay. The curing should be thoroughly done before the crop is stored. The seed may be shelled by drawing the heads of the flax through a comb of sharp iron teeth set quite close together, by whipping them over a large stone, by threshing with flails, or by running through a machine. The second method is the best where only a small quantity is grown, while a good machine will be needed if the crop is very large.

Various methods of preparing the fibre are in use. The end to be gained is the separation of the bark from the woody stem. This is accomplished by a rotting process which dissolves the mucilaginous substance which holds them together and thus admits of their easy separation. The flax is either spread upon the grass, or in the form of bundles is put under standing water until, by means of various mechanical operations, the fibre can be separated from the stem. These things were once done on the farm, but now after the seed is removed the larger part of the straw is sold to parties engaged in manufacturing. In this country flax is mainly grown for the seed, and but little

attention is paid to securing a good article of fibre. From the seed linseed oil is obtained, and the justly celebrated oil cake which is so highly valued for feeding purposes. This cake consists of the seeds after the oil has been expressed. Large quantities are sent to ENGLAND, where it commands a high price. It is especially valuable for feeding to lambs and calves.

Flax is an exhausting crop, and should not be grown upon the same field more than once in five or six years. In the vicinity of factories, at which the straw can be sold and the seed utilized, it may be made a profitable crop to be grown on a small area and in a judicious system of rotation, but present indications are not favorable to its extensive cultivation.

HEMP.—Although not one of the most valuable plants, hemp has been cultivated to quite an extent at the WEST. Properly managed it pays a fair profit, but it has never been very popular and the quantity grown in this country has never equalled the demand. It is somewhat exhausting to the soil, and this, together with the fact that the labor of cutting and gathering it is severe, will prevent its taking a high place among our crops. It can be grown to better advantage in some of the foreign lands where labor is very cheap and where some of our better crops do not thrive.

The method of growing hemp is very simple. The land should be carefully fitted. A deep, mellow, and fertile soil gives the best results. Care must be taken to secure fresh seed. The sowing may be done from the middle of April to the middle of June, though it is usually better to get in the seed as soon as convenient after the land gets warm and dry in the spring. From one bushel to one bushel and a half of seed per acre is usually scattered broadcast over the field. It is very much better to drill in from three pecks to one bushel of seed per acre. If the ground is moist, the seed should be lightly covered. If dry, the seed should be soaked before the sowing is done or else it should be put in deeper than seeds are usually cov-

ered. In all cases the land should be well rolled after the sowing has been done.

Hemp is a very strong growing plant and will readily take care of itself. Little or no cultivation is required. Unless the land is very weedy, and much of the seed fails to grow, the hemp will smother the weeds.

In from three to four months after sowing the crop will be ready to be cut. This stage will be indicated by the turning yellow of the blossoms and the falling of many of the leaves. The common practice used to be to pull the plants by hand, but cutting is now the usual method. In either way the work of gathering the crop is very hard and slow. If the hemp is not above seven feet in height it can be cut at the rate of an acre a day, per man, with wide, heavy scythes, but if it is very tall a hemp hook, or brush scythe, must be used. With one of these implements a man can only cut about half an acre of hemp per day. It should be considerably dried and then bound and stacked. When the weather becomes cool it may be spread on the grass to rot, or the rotting may be done in vats, or ponds, in which the stalks can be kept constantly under water. When sufficiently rotted, the fibres will separate from the stalk along its centre but remain attached at the ends. It is then taken to the brake, with which the separation is completed. These brakes were formerly made by the farmer, or some local carpenter, but a good machine for breaking hemp and flax, and separating the seed from the latter, is now for sale by dealers in agricultural implements.

In ENGLAND, hemp which is designed for seed is grown the same as when produced for the fibre. The male stalks are gathered first, while the female plants are allowed to remain until the seeds are ripe. But in this country the seed is grown in a field by itself. The planting is in hills, which should be three and a half feet apart each way. Sufficient cultivation should be given to keep down the weeds. Only three stalks in

a hill should be allowed to grow. When sufficiently developed to make plain the difference between the male and female plants, the former, which may be known by their preparation to blossom, must nearly all be cut out. The rule is to leave one blossoming plant in every other hill of every other row. These will fertilize the female plants, and secure the production of perfect seed. After the pollen has fallen from the male stalks, they should be removed in order to leave more room and food for the productive plants.

The seed is of some value for feeding to stock, but should be cooked before being used. The fibre is valuable for manufacturing purposes, and the waste is sometimes used for making paper. When only the fibre is produced, this crop is not very exhausting to the soil; but when the seed is ripened, it takes the elements of plant-food in large quantities, and proves very damaging to the land.

JUTE.—Although large quantities of jute are used in this country, INDIA has been, and still is, the main source of supply. Many experiments which have been conducted, at the suggestion of the AGRICULTURAL DEPARTMENT at WASHINGTON, in the SOUTH, have proved beyond all question that this can be made a valuable addition to our cultivated crops, and that if its culture were once established, millions of dollars per year would be kept at home which are now sent abroad for this product. The soil and climate of the extreme SOUTHERN States are well adapted to the production of this crop. But comparatively little labor is required, and to quite an extent it would pay better than cotton or cane.

The seed may be sown in April and the plants cut in July, or sown in June and cut in September. The plant grows from ten to fifteen feet in height, and a yield of thirty-five hundred pounds of fibre per acre can readily be obtained. The seed may be scattered broadcast at the rate of twenty or thirty pounds per acre, or drilled in at the rate of ten or fifteen

pounds. The plant is a strong grower, and will pretty much take care of itself. For the production of fibre the plants must be cut when in the flower. Plants for seeds should be grown in a separate field. They should have good land and careful cultivation. The seeds are ripe in about a month after the flowers are developed.

The stalks of the main crop are subjected to a rotting process similar to that which is practiced with flax and hemp. When well rotted, the fibre is separated from the stalk. The fibre can be used for all the low-priced manufactures which flax and hemp have hitherto supplied. Large quantities of paper have been made from jute, and it can be used for many other purposes. There can be no doubt that in the SOUTH this plant will pay better than either of its rivals. Instead of sending millions of dollars out of the country to purchase a supply of this material, an abundance of it should be grown at home, and worked up in our own manufactories. Grown in connection with other crops, jute promises large and sure rewards to the SOUTHERN farmer.

OATS.—The oat plant is a native of cold countries, but readily adapts itself to temperate localities. It can be grown where the summers are long and hot; but in these locations it does not flourish. There are several varieties, and a large number of sub-varieties. The latter exhibit merely those changes which are naturally due to a difference in the surroundings of the plants. New kinds are frequently introduced, loudly praised, widely advertised, and sold at extremely high prices to farmers in all parts of the country. Some of these sorts prove quite valuable. Others are not adapted to general cultivation. Under the general system of culture practiced here, the oat rapidly degenerates. This is especially true at the SOUTH. Oats imported from NORWAY, SCOTLAND, or even from CANADA, are quite heavy. Some of these oats will weigh forty pounds per bushel. But if sown in the MIDDLE or SOUTHERN States their product is not as

heavy, and they soon degenerate to the common local standard. The same change occurs, but not quite as rapidly, in the NORTHERN States. We are confident that by careful culture, and a proper selection of seed, this deterioration can be prevented. If the farmer will grow his oats for seed on good land, and give them good culture, he can keep them up to their original standard of excellence. He may even improve their quality, and increase their productive capacity.

The question, Which is the best variety for general use? is not settled. Many farmers consider the white oat superior to the black, while others are sure that the black kinds are the best. We have grown both the white and the black oats—several kinds of the former and one of the latter—and we like the white ones much the best. Our black oats were strong growers, and gave a good yield, but they did not sell as well, did not look as well, and we found no point in which they were at all superior. Of the white oats, the best kind which we have grown which laid claim to a name of its own is the SURPRISE. We had an unnamed variety, which was brought from a hill-town, in MASSACHUSETTS, which we kept for some years, and which, all things considered, was fully equal to any which we have ever grown.

Though it may sometimes be well to "change the seed," we do not think it either necessary or wise to make such changes often. When such a course is decided upon, the new seed should be obtained from some mountainous region. The SOUTHERN growers will do better to get seed-oats from the mountains in their own vicinity than they can by sending NORTH. The NORTHERN oats will soon become acclimated. They will probably yield well, but we think that SOUTHERN grown grain will prove to be better adapted to the SOUTHERN States. By getting a good variety from the mountains, and carefully growing a small field specially for the production of seed, the SOUTHERN farmer can grow his own seed-oats and keep the highest quality of the variety unimpaired.

Oats will thrive on almost any kind of soil which is not very wet. Standing water is death to the plant, and it will not do well if the land is constantly soaked. On good land a much larger yield can be obtained than can be secured from a poor soil, but something of a crop can be obtained from land which is very far from being fertile. This crop is sometimes grown on an inverted sod, but this practice is not considered the best. Oats follow corn or potatoes very well. No green barn-yard-manure should be applied to the land, but it is a great mistake to suppose that all fertilizers are injurious to the crop. Well-rotted compost may be harrowed in, and it will pay well to use it for this purpose. Special fertilizers for the oat crop may often be made very profitable. They are especially valuable on land which has long been cropped. On many soils two or three bushels of salt per acre may be advantageously used. When oats are grown on sod, this application of salt should never be omitted. On land upon which grain is likely to lodge it will also prove useful.

The oat crop has obtained the reputation of being very exhausting to the soil. This is a bad name which is wholly undeserved. An analysis of the plant shows that it requires quite a quantity of nitrogen, but does not take as much phosphoric acid and potash from the soil as several of our other crops. The amount of nitrogen is not excessive, and the actual exhaustion of the soil is less than it is in the production of either wheat or corn. The idea that oats rapidly exhaust the soil probably comes from the fact that seeding with oats often proves a failure, and that grass following oats does not give as large crops as when it follows corn. But an ample reason for these things can be found without resorting to the theory that the oats have impoverished the soil. We have little trouble in seeding with oats, though rye is a better crop for the purpose. The difficulty of seeding with oats results from the fact that the oat is a strong growing plant, and it shades, and some-

times smothers, the weak grass plants. The cause of the land being in poor condition after the crop is removed is generally due to the fact that it has received no fertilizers. If corn were planted, instead of oats, without manure, the land would be made poorer. In this case the trouble is not with the oats, but with the method of cultivation. If the land is manured for oats as well as it is for corn, grass will follow the former crop fully as well as it will the latter.

The land for oats should be plowed to a medium depth, and the surface soil made very fine. The sowing should be done early in the season—just as soon as the land is tolerably dry and warm in spring. Oats which are sown late are almost invariably light and poor. We would prefer to sow when the land is rather cold than to wait until late in the season for it to become warm. At the SOUTH many oats are sown in the fall. At the NORTH the severe cold of winter destroys the plants. A hardy variety,

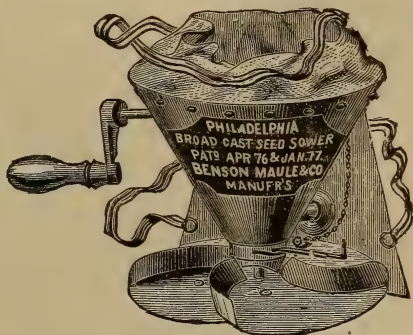


FIG. 12.

called winter oats, is now grown in the mountains of Tennessee. A good crop was also grown in SOUTH FRAMINGHAM, MASSACHUSETTS, by E. F. BOWDITCH, ESQ., in 1878. Whether their culture will be generally successful as far North as this, a more extensive trial must determine. After the land is thoroughly prepared, the seed may be sown broadcast at the rate of from one to four bushels per acre. We have seeded as lightly as one bushel, but generally use three. The seed should be covered with a light harrow, and the land, unless it is wet and inclined to bake, should be well rolled. For sowing oats, and other kinds of grain which are scattered broadcast, a machine will do much better work than can be performed by hand, and also do

it very rapidly. Fig. 12 represents a hand-machine which will sow from four to six acres, and Fig. 13 a horse-machine sowing from twelve to fifteen acres *per hour*. Both machines are made and sold by Benson, Maule & Co., of Philadelphia.

Oats should be harvested when the lower part of the stalk has turned yellow and the kernel has fairly passed out of the milk. If cut at this stage the grain will be plump, and the straw will be good for fodder. If allowed to stand longer, the quality of the straw will be impaired, and the grain will be very likely to



FIG. 13.

shell in the field. Great losses are often sustained by allowing this crop to become too ripe before it is cut. When grown on a small scale the oats may be cradled, allowed to dry a day or two, and then bound in small bundles, which should either be set up in small stooks in the field, or stored in a well-ventilated loft in the barn. It is very important that the oats should be quite dry before they are packed away. Otherwise they will heat badly and the grain will be discolored. It is also highly necessary that they should be got in without much exposure to rains and heavy dews. The grain is easily discolored by rain,

and the price which it will command in market is thereby considerably reduced. If rain falls upon the swath, they should be turned over and carefully dried before being bound. When the weather is cloudy it is sometimes best to put up the grain in small stooks, and allow it to stand a week or two. The butts should be exposed to the sun a few hours before the bundles are packed away in mows. It is always best to cut this crop in good weather, dry it well before binding, and when it is bound haul it at once to the barn or stack. When a reaper is used, as it should be where large fields of oats are to be cut, the binding may be done at once and the bundles put up in small stooks to dry.

The oat is liable to but few diseases. The straw makes excellent fodder, and the grain is one of the best for feeding to working animals. When properly prepared, it forms one of the most healthful and nutritious kinds of food for man. When the crop is designed for fodder it should be cut early and cured like hay. In this form it makes a splendid food for cows which are giving milk. It is also valuable for feeding to other stock, especially to sheep. Either for grain or fodder the oat is a valuable plant and is well worthy of the best cultivation.

PEAS.—In ENGLAND, CANADA, and some parts of this country considerable attention is paid to growing peas as a field crop. Here they have not become a prominent crop, though many growers speak very highly of their value. They are used for feeding to hogs, sheep, and hens. They will grow in almost any soil, but yield much larger crops on rich land than they do elsewhere. No green manure should be used, but a coating of well-rotted compost may be plowed in, or worked in with a cultivator. The land should be plowed to a moderate depth, and the surface soil well pulverized. The seed is usually sown broadcast at the rate of from two to three bushels per acre. It should be covered with a small plow or a cultivator. A harrow does not cover deeply enough. After the seed is covered the

land should be rolled. This must not be neglected, as the labor of gathering will be much increased if the surface of the land is rough. Some farmers sow peas with oats in order that the latter may furnish a support and keep the vines from the ground. But as the two do not ripen together, and as the oats are not strong enough to fully answer the purpose for which they are sown, many growers prefer to sow the peas alone.

Peas are often grown in the corn fields. Here they are drilled in between the rows of corn. This practice obtains more at the SOUTH than it does elsewhere. The best farmers prefer the month of May for sowing peas in corn fields, but some growers wait until June. At the NORTH the planting should be done as early as the first of June. If wanted for feeding green, the first planting may be in April, and later ones at intervals of three weeks. This will give a succession through the fall. The varieties most in use at the NORTH are the marrowfat, a large and rather late pea which needs a strong soil, and the small yellow pea, which is a favorite in CANADA and will thrive on light land. At the SOUTH the large cow pea is extensively grown for stock.

The "Pindar," a leguminous plant resembling both the pea and the bean, is also a favorite in this section. The vines are good for fodder, and the seeds, which to the amount of from twenty-five to fifty bushels per acre ripen beneath the surface of the land, are excellent for fattening animals. When ripe the pods are loosened with a fork and then pulled with the vines, turned out with a light plow, or else the hogs are let into the field to harvest the crop as they want it for food. This crop is often grown for market. The method of its cultivation for this purpose will be considered in the proper place.

The ordinary peas may be fed from the time when they are half grown until they are fully ripe. If cut and cured while green, they make good hay for cows and sheep. Some growers turn their stock into the fields, but this is a wasteful prac-

tice. If the peas are wanted, they should remain until nearly ripe. Then they should be cut with a scythe, cured like hay, and carried to the barn and threshed. For feeding to hogs seven bushels of peas are said to be equal to ten of corn. They may be soaked in milk or water until they are soft and fed alone, or may be ground into meal and mixed with milk and other food. The whole peas are often fed dry, but the practice is not a good one. We have used them to some extent, and think it better to grind peas and corn together than it is to use the peas alone. The crop is not very exhausting, and when sowed late it is of great value for giving the soil a good covering during the hot weather.

RICE.—The cultivation of rice in this country is necessarily confined within quite narrow limits. The plant requires for its perfection a moist soil which can be readily inundated, and a hot climate. It can be grown to some extent on uplands, but cannot there be made a very profitable crop. In the swamps of SOUTH CAROLINA and MISSISSIPPI it is very productive, and is one of the best paying crops. There is this drawback, however: the locations in which rice flourishes are very unhealthy. The labor required for the production of a crop is slight. When grown on upland it should be planted in shallow drills two and a half or three feet apart. The land should be kept free from weeds by the use of the cultivator and hand-hoe. But all varieties of rice succeed much better in lowlands than they do in a comparatively dry soil.

The rice field should be so arranged that it can be inundated at will. About two bushels of the grain per acre is sowed broadcast upon a thoroughly prepared surface, and covered lightly with a smoothing harrow, or a similar implement. This is to be done in March. After sowing, a little water is let on. This remains two or three days. The grain then begins to swell and the water is withdrawn. When the plant is three or four inches high, water is let on until all but the top leaves are

covered. This remains until about two weeks before harvest-time, when the water is drawn off in order that the stalks may harden, and that the process of gathering the crop may be facilitated. This is the simplest method of culture which can be made successful. Some growers do a great deal more work. They draw off the water, and weed and hoe the plants three or four times during the season. If the land is full of strong growing aquatic plants, this course may be necessary. Otherwise it can hardly be made to pay.

RYE.—This crop is extensively grown in the EASTERN and MIDDLE States, and is frequently produced on those wheat fields of the WEST, which, from severe cropping with wheat alone, have become partially exhausted. It is a hardy plant, and succeeds in a large variety of soils, and in different climates. Wet land is not adapted to its production, and should be drained before this crop is tried. Rye will grow on very poor land, but fertile soils will produce much larger crops. It is not very exhausting, but when it is grown upon the same land year after year, and no manure is applied, the soil at length becomes extremely poor. It does not require a large proportion of the principal elements which the other grain crops use. Consequently exhaustion goes on slowly. Some farmers have claimed that for an indefinite time rye can be grown year after year without manure, and without either diminishing the yield of the crop, or impairing the fertility of the soil. The only thing needed to prevent exhaustion is the turning under of the stubble as soon as a crop is removed. That this opinion is erroneous must be evident to the man who will give the subject attention. The course proposed, and it is followed by many farmers, involves the removal each year of *all* the grain, and almost all of the straw, which the land can produce, without the slightest return of any substance with which to repair this inevitable waste. The disintegration of the soil, which in nearly exhausted fields is going on very slowly, is the only

source from which the mineral elements which the crop requires can be obtained. If we estimate the crop at only ten bushels per acre, there will be a removal of five hundred and sixty pounds of grain, and about ten hundred pounds of straw, for which no equivalent whatever is rendered. Under such treatment the land must inevitably grow poorer year by year. Even this small crop would take from the land each season about fifteen pounds of ammonia, seven pounds of phosphoric acid, and eleven pounds of potash. It also withdraws several other elements which are not easily exhausted, but in which, under a bad system of culture, the soil may become deficient. Such a course can have only one end, and that is barrenness. We have cultivated exhausted rye fields, and found them terribly poor. Rye will continue to grow on land too poor to produce any other crop than itself and buckwheat. But when the end is reached, when the soil is so thoroughly exhausted that it will grow rye no longer, it is, for all present purposes, utterly ruined. A long rest, or the use of large quantities of fertilizing matter, can, in time, restore it to fertility. But a great deal of time must be given, or a heavy expense must be incurred. Rye seems to be able to take the last available element of plant-food from the soil. Consequently, though it may pay well for a few seasons, it is a ruinous crop to be grown on poor land without manure.

Though rye will grow on a very large variety of soils, it gives the best quality of grain when sown on a rather dry and sandy plain. Much larger quantities can be grown upon a rich loam. The straw is very strong, and will bear a heavily filled head without lodging. The land may be manured with well-rotted compost, ashes, or chemical fertilizers. Green manures prove highly beneficial to this crop. The land should be well plowed to a moderate depth, and harrowed before the seed is sown. If the winter rye is to be grown, the sowing should be done between the middle of August and the first of November,

except on very poor land, where it may be attended to as early as the first of August. For good land we prefer the middle of September. We have known the seed to be put in so extremely late that it did not grow until the next spring. It then came up well and produced a good crop. But this late sowing is not advisable. When the plants make only a very slight growth before winter, there is considerable danger that they will be destroyed by the cold weather, and the heaving of the ground. The spring rye, which is a modification of winter rye which has been caused by very late sowing in the fall for many successive years, should be sowed when the ground is in a suitable condition to receive the seed. In some localities where spring rye was once largely grown, it has almost entirely disappeared, and winter rye has taken its place. We much prefer the winter grain.

In the EAST, rye frequently follows corn and receives no fertilizer. The seed is sometimes sown before the corn is ripe, and is covered with a cultivator and hoes. In this way the corn receives a late hoeing, and the rye obtains an early start. A much more common method is to cut a few rows of corn, plow a narrow strip of land, sow it to rye, and then stack upon the plowed land the corn which has been cut. These strips are plowed at convenient intervals. Then the remainder of the corn is cut and stacked upon these strips, and the rest of the land is plowed and sowed. Some farmers take an opposite course. They cut their corn and set it up, making as few rows of stacks as possible, and then plow and sow all the land except what the rows of stacks occupy. When the corn is cured, the stacks are drawn to the barn, and the land upon which they stood is plowed and sowed. As the corn must be carried quite a distance in order that it may make but a few rows and occupy as little land as possible, this course involves some extra work. The rye will not ripen on these strips at the same time that it does on the remainder of the land, and the harvesting must be

performed at different times, or else considerable of the grain will be wasted. Many farmers consider the advantages gained by early sowing much greater than the inconvenience which either of these methods involves. Our own course has been to remove the corn as soon as possible, sometimes stacking it in another field, and then sow the rye.

The quantity of seed required depends somewhat upon the character of the land and the time of sowing. On light land, if put in very early, three pecks per acre may be sufficient. On good land sowed in moderate season, a bushel will be better. If the sowing is very late and the land has not been put in first-rate order, from one and a half to two bushels may be needed. But it is much better to fit the land well and sow a reasonable quantity of seed early in the season, than it is to wait until almost winter and then try to atone for the delay by using an excessive amount. If drilled in, only a bushel per acre will be needed on ordinary land. If grown for fodder, very thick sowing will be the best. Three bushels of seed per acre should be used for this purpose.

The principal disease to which rye is subject is the ergot—a fungoid growth—which causes the heads of the grain to turn black, and send out long spurs which are quite poisonous. In EUROPE several epidemics have been traced to the use of rye affected by ergot, and in this country many cases of sickness, both of men and animals, have doubtless been caused in the same way. The mills in which rye is ground are now so much improved that most of this poison is separated from the grain, and kept out of the flour; but still there is risk in using grain which has been thus affected. In any quantity it is a violent poison to domestic animals. No cure for this disease is known. Prevention must be tried. Only the finest kernels should be used for seed. If possible, the seed should be obtained from a field in which the disease did not appear. Before sowing, the seed should be put into strong, hot brine, thoroughly stirred,

then spread on a floor and dusted with lime. The light kernels, which rise to the surface when the grain is put into the brine, should be skimmed off and thrown away. With this care in selecting and preparing the seed there should be but little trouble in obtaining a healthy crop. The color of the grain and its quality for making flour will be greatly modified by the soil upon which it is grown. Dry, sandy plains furnish the nicest-looking rye. The grain is very white, and the flour made from it looks nearly as well as that from wheat. It is by some called the white rye, in distinction from the black rye, which is grown upon heavier soils. But if seed is obtained from these plains and grown upon the meadows, quite a proportion of the product will be the ordinary black rye. The second year the change will be more strongly marked, and in a few seasons all trace of the white rye will be lost. It is possible that the use of chemical fertilizers in place of barn-yard-manure would retard this change.

The cutting may be done with a reaper, or the rye can be cradled by hand. When the color of the straw changes and the kernel passes out of the milk, it is time to cut this grain. If free from weeds, it can be left a day or two to dry, and then bound and put into the stack or the barn. But if weedy, or the weather is bad, the rye may be bound and set up in stooks of ten or twelve bundles each. Some farmers leave it out until they are ready to thresh it, but it is much better to be placed under cover as soon as it is dry.

Rye straw is very useful for bedding animals, and usually sells higher than other kinds of straw. It is very tough, and usually grows quite long. Many farmers use it for binding corn. For this purpose it is much better if cut before it is ripe. It will be very strong, but it will not hurt the hands like the straw of well-ripened grain. In some localities rye straw is in demand at paper mills. It is valuable for manure, but will often **sell** for more than it is worth for this purpose. As a soiling

crop and for late pasturing for sheep, green rye is a valuable crop. Rye is one of the best of all the grain crops with which to get in grass-seed. The seed should be sown after the rye has been covered with a harrow, and then either bushed in or covered with a heavy roller. On light land both the bushing and rolling would be beneficial.

WHEAT.—This is one of the leading crops not only of this country but of the whole civilized world. From the earliest ages wheat has been grown as food for man. It is emphatically a grain for the intelligent races. Rice supports a large part of the vast population of INDIA and CHINA, and corn, oats, rye and other grains, furnish food for multitudes of the human race, but the fact that wheat forms one of the principal articles of diet of the most powerful and the most thoroughly civilized nations of the earth cannot be denied. It has been, and it will be, a leading article of the food of the most intelligent races of men.

Wheat can be grown in a large variety of soils, and has the power of adapting itself to either cold or warm climates. But it finds its most congenial home in the temperate zones, and in a rather heavy and fertile soil. There are many different varieties. Some of these kinds are more hardy than others, and from the list of cultivated sorts some can be found which are well adapted to any section of the UNITED STATES. The kinds which give the best results at the SOUTH are not hardy enough for the NORTH and the NORTHWEST, but there are plenty of good varieties which will do well in these sections. By means of a gradual change in the time of sowing, wheat has been obtained which need not be sown until spring.

In localities where it succeeds, winter wheat is usually considered the best. It makes a stronger growth of straw and gives a larger yield of grain. When treated in the ordinary manner it also makes nicer flour than the spring varieties. But by the patent "new process" of grinding, the finest quality and highest-priced flour is obtained from spring wheat. Many

of the winter varieties are not hardy enough for the extreme North. In unfavorable seasons they "winter-kill" badly. This is sometimes owing to imperfect preparation of the land, but much of it is due to the tenderness of the plant. Where the winters are long and severe there will be considerable risk in sowing wheat in the fall. For such localities the spring varieties are safer and better for the farmer to produce.

Of both winter and spring wheat there are many different varieties. Among those which have been very popular may be named the Diehl and White Mediterranean (white), the Golden Straw (amber), and the Mediterranean Red, a red variety. For spring wheat the Black Sea and the Rio Grande have proved quite valuable. Among the later and probably very much better kinds may be named the Clawson (white) and the Fultz (red) for winter, and the Champlain and the Defiance for spring varieties. Although it is doubtful if any variety will ever be found which will do equally well in all sections, it is probable that some one of the four kinds last named can be made profitable in any part of the country. The Defiance is very hardy and will succeed at the extreme NORTH. We think the Clawson and Fultz will both succeed at the SOUTH.

Although it is a very important item, the securing of a good variety is only one among several things to which the successful wheat-grower must give his attention. More than with almost any other crop the preparation of the land is one of the determining influences which govern the yield of grain. When it gets well started wheat grows rapidly, but it is not a very vigorous plant, and cannot fight its way as well as many of our cultivated grains. In order to make success reasonably certain it is necessary that the land should be very carefully fitted to receive the seed. If the soil is very rich, it is all the better. If the land has been partially exhausted, an abundance of plant-food must be supplied. This food must be in a condition for immediate use. Coarse manures will do little good. The

wheat plant is a delicate feeder, and its food must be carefully prepared. A large crop of clover which has received a good coating of lime and plaster may be plowed in a few weeks before the wheat is sown, and made to yield a large amount of good food for the crop. We do not approve of sowing upon a clover sod until it has got well settled and also had a little time in which to decay. Wheat may follow corn if the land was made very rich for the latter crop, and it is removed as soon as ripe. In this case, however, some chemical fertilizer for wheat should be used. In any and every case the land should be made rich, and the plant-food which it contains must be near the surface. For this crop we have a great deal of faith in special fertilizers, and also in the complete manures which are sent out by the manufacturers of the special grades. This because the ordinary farm-yard-manure does not usually get fine enough to give its best results to the crop to which it is directly applied. Much of it remains in the soil to benefit succeeding crops. Its effects are often visible four or five years. When this alone is used, the wheat crop is not sufficiently nourished. There may be food enough in the soil, but it is not immediately useful, and the wheat crop is partially starved. But chemical manures furnish an abundance of food in a fine condition and all ready for use.

They cost something, it is true, but they often save the crop. Take a corn field which was not highly manured and sow wheat without any fertilizer. Thousands of acres are sowed in this way every year. The result is that in moderately favorable seasons the crop yields from ten to fifteen, possibly twenty, bushels per acre. Now take this same land and at the time of sowing apply four hundred to six hundred pounds of a special wheat fertilizer, or the same quantity of a complete fertilizer, costing from eight to fifteen dollars, and the yield will be increased from twenty to thirty bushels per acre. This may seem almost incredible, but it has been proved true by the experience of a large number of our best farmers. In the first instance the

crop had but very little food and the yield was light. In the latter the crop had the same quantity of food as the other plan provided, and, in the form of commercial manures, surplus food enough, in an immediately available condition, to bring up the yield to a high figure. The application of ten dollars worth of available fertilizers often returns twenty or thirty dollars worth of grain.

It is very important that the surface soil should be made extremely fine. Wheat should be grown, when possible, upon land which has been deeply cultivated and underdrained, but for the wheat the ploughing should be shallow. The work should be well done, the harrowing should be very thorough, and plenty of plant-food ought to be furnished *near the surface*.



FIG. 14.



FIG. 15.

Then the seed may be sowed at the rate of two bushels per acre, if broadcast, and of from one and a fourth to one and a half, if drilled. Figs. 14 and 15 were designed to show the relative appearance of broadcast and drilled wheat. Fig. 16 represents the Hoosier Grain-Drill, a first-class machine, manufactured by the Hoosier Drill Company, Richmond, Ind.

Too much stress can hardly be laid upon a thorough preparation of the soil. Under the common system of management all that can be done towards making the crop is finished when the sowing is performed. But implements for the cultivation of wheat have been invented, and it is to be hoped that they will soon come into general use. By their use the average yield per acre of wheat planted in drills can be largely increased.

The best time for sowing wheat depends upon various circumstances. When winter wheat is grown, we think from the first to the last of September at the NORTH, and from the middle of October to the middle of November at the SOUTH, will give the

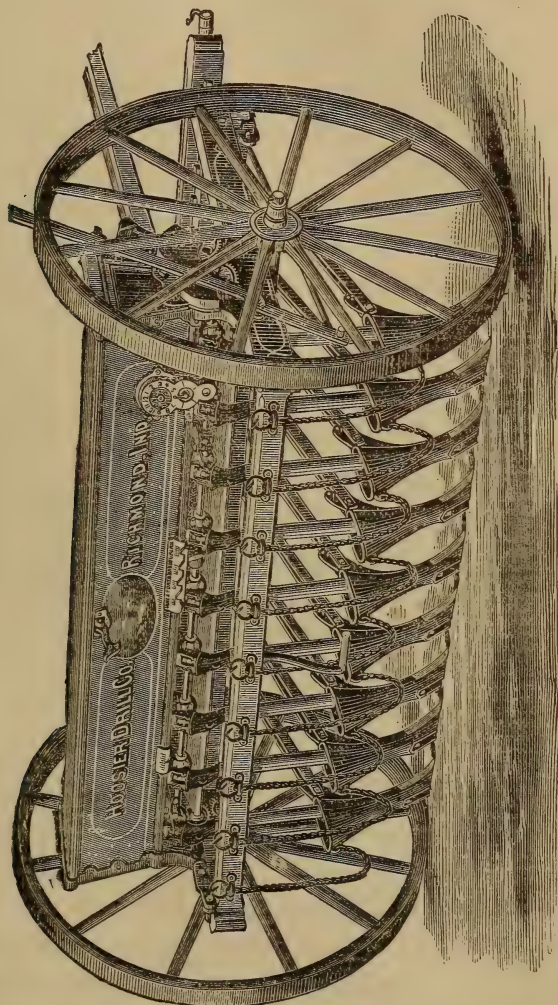


FIG. 16.

best results. With spring wheat it is important to get in the seed as early as the state of the weather and the condition of the land will admit. The time for sowing winter wheat is sometimes modified by the appearance of the Hessian fly—late sow-

ing being adopted in order to avoid the ravages of this small but destructive enemy.

The diseases of wheat are more serious than those to which rye is subject. The most destructive are smut and rust. The former is a fungoid disease, propagated by spores, and utterly ruins all the wheat plants which it attacks. The microscopic plants absorb all the nutritive juices of the stalks to which they are attached, and while preventing the full development of the grains, convert them into a highly poisonous substance. As it first attacks the weaker grains, it is important to use only the largest and nicest kernels for seed. If possible, seed should be obtained from an unaffected field. Before sowing, soak the seed in very strong hot brine, stir it several times, letting it settle between, and skim off all the light and imperfect kernels which rise to the top. Then roll the seed in slaked lime and sow at once. The rust which attacks the wheat plant is also a microscopic fungus and often works an immense amount of evil. Winter wheat is more likely to suffer from the attacks of this disease than spring grain, and some varieties are more readily affected than others. This disease is also more likely to attack weak plants than those which are strong, and may be partially prevented by using the best seed from fields which have not been attacked. The seed should be put into brine as directed for smut, then rolled in slaked lime and sowed at once. PROF. PENDLETON recommends the use of a solution of bluestone (one-fourth of a pound to a bushel of wheat) for both rust and smut. The brine may be used first, if desired, and the wheat allowed to remain in the bluestone solution several hours.

The insect enemies of the wheat plant are very formidable. They are members of the different classes of flies, weevils, caterpillars, bugs and worms. The most destructive are the chinch-bug, and the Hessian fly. The former resembles the bed-bug in appearance, and attacks both wheat and corn. It begins to work on these crops about the middle of June. The Hessian

fly lays its eggs on the leaves of the wheat plants near the stalk, and provides for two or three broods each year. The first brood appears in April and May, the second in July and August, and sometimes a third appears in October. In from four to ten days after the eggs are deposited upon the leaves the maggots appear, and work down the leaf between the sheath and the stem to a joint. Here they attach themselves to the stalk, and live upon the juices of the plant. Sometimes several of these maggots attack the same joint, and weaken it so that the plant breaks down at this place. The maggot increases in size, passes into the pupa state, and comes out a fly about the first of August. Such a drain upon the plant proves very injurious, and it often happens that crops are utterly ruined thereby. The various remedies are late sowing, pasturing the wheat, mowing, rolling, and burning the stubble. If the sowing is deferred until the fly has laid its eggs, the wheat escapes the first brood; but wheat put in very late seldom gets a good start, and is quite likely to winter-kill. If sheep enough are turned into the field to eat down the grain in one or two days, most of the eggs will be destroyed. Mowing the tops and feeding them to stock does much to keep the eggs from hatching. Rolling crushes many of the eggs. Burning the stubble in the summer, as soon as the grain is cut, is a still more efficient remedy. But all of these methods have their disadvantages, and none of them furnish absolute protection. The grower should make the land very rich, and give the grain every possible advantage in order that it may make a vigorous growth, and be able not only to support the insects which prey upon it, but also to become fully developed, and yield a good crop in spite of their depredations. PROF. COOK, of the MICHIGAN AGRICULTURAL COLLEGE, in a lecture upon this subject, said that the flies will lay their eggs upon the first suitable plants which they can find after they are ready to lay. If they can find none which they think will answer the purpose, they will

wait a while. He recommends the sowing of "a narrow strip of wheat about each field in August or early in September, and to put off, as long as the season permits, sowing the wheat that is to be raised. Most of the eggs will then be laid upon this early wheat, which should be plowed under deeply as soon as the later wheat is planted. This outer strip may then be sowed again." This seems the best plan which has yet been proposed for saving the wheat, and destroying the fly at the same time. In case the insects appear in the spring, resort must be had to pasturing with sheep, or mowing and removing the tops. These precautions, in connection with careful selection of seed, the choice of the strong growing varieties which stool largely, and high manuring, will usually enable the farmer to grow a

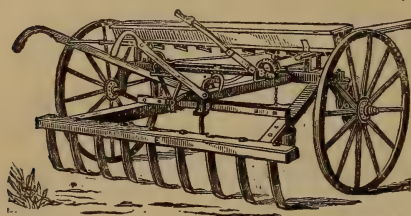


FIG. 17.—TRAVIS' WHEAT-HOE AND SEEDER.

good crop of wheat in spite of its insect enemies.

Until quite recently no effort has been made in this country to cultivate wheat during the period of its

growth. But a few years ago Mr. A. B. Travis, of Brandon, Michigan, invented a machine for doing this work, which seems destined to prove quite useful where the seed is put in with drills. In Fig. 17, we present an illustration of this implement combined as a seeder and hoe. The teeth and arms of the hoe are attached to the head by means of clips, and can easily be attached to any make of drill, and adjusted to any width of row. It is claimed that the use of this machine will prevent lodging of the grain, and will largely increase the quantity of the crop. Many practical farmers have tested this hoe, and been highly pleased with its work. It has also received diplomas at various State Fairs, and at the Centennial Exposition.

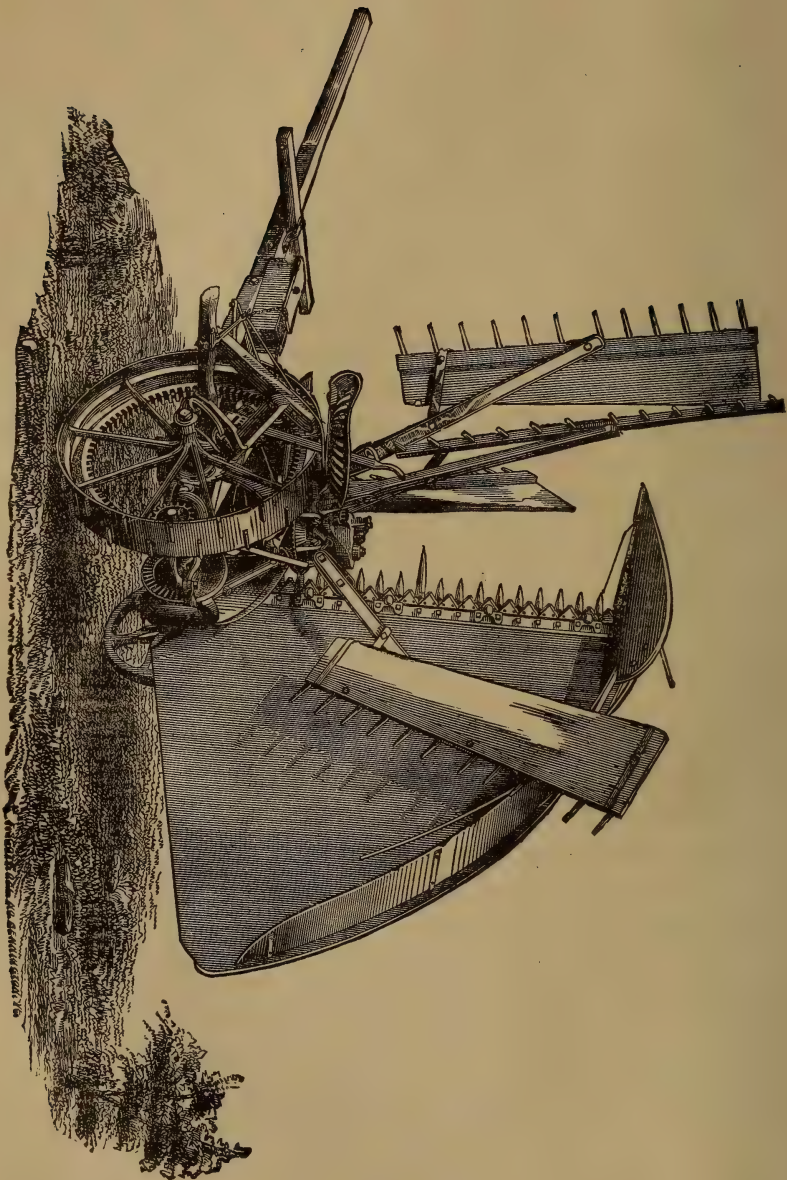
The different varieties of wheat will mix very readily if planted near each other, and the mixture almost always proves

injurious to the character of the grain. If two kinds are grown, they should be in different and distant fields. The variety which seems the best adapted to the climate, soil, and cultivation which can be given, should be selected, and not only be kept strictly pure, but an effort should be made to improve it. The wheat for seed should be grown in a plot set aside for the purpose, and should have the best care and most skilful culture which the owner can bestow. From the yield of this plot, the largest and nicest grains should be selected for the seed of the next season's crop. It is some work to do this, but it will pay well to give it attention. A difference of several bushels per acre in the yield is often made by a difference in the seed. With the best land, the best fertilizers, and the greatest care, a large crop of wheat cannot be grown from inferior seed. But give these things, and good seed in addition, and large and profitable crops will be regularly secured.

Harvesting must be done when the straw near the ground has turned yellow and the interior of the kernels has passed from the milk into the dough state. If cut before this time the straw will be more valuable for fodder, but the grain will shrink and give small measure and light weight. If it stands later, the straw will become hard and the grain will shell easily and be wasted in the field. If only a few acres are grown, the wheat can be cut by hand, but large fields should be cut with a reaper. Figure 18 represents W. A. Wood's Sweep-Rake Reaper. Figure 19 shows his splendid Self-Binding Harvester.

It is better to hire a reaper, if one is not owned, than to attempt the cutting of a large field by hand. For the hand work will inevitably be slow, and, while it is going on, much of the grain will get over-ripe and quite a loss will thus be sustained. When cut, the grain should be bound and either stacked or, if only a little is grown, drawn to the barn. Some farmers prefer to put it in small stooks. If the grain is full of green weeds, or is not well ripened, this is the best way. Other-

FIG. 18.—WALTER A. WOOD'S SWEEP-RAKE REAPER.



wise it may be stored in larger quantities. Of late the practice of threshing from the shock and hauling the grain to market has come into favor with a large class of farmers. In some seasons this appears to be the best method, but, after ripening in a very warm and rainy time, the grain should be stacked and go through what is ordinarily called the "sweat." When wheat is stacked, the straw and grain will soon become damp and considerable heat will be evolved. During this stage the grain cannot well be threshed, as it sticks very closely to the straw. After a few days the "sweat" is over and both grain and straw become dry. It will then be found that the color of the kernel has undergone a change, and that it is larger in size than it was when the grain was stacked. The berry has absorbed nutritive matter from the stalk and will make better flour, and probably a larger quantity, than it would if it had not been stacked. And by brightening the color of the grain the sweating will add from three to ten cents a bushel to the selling price.

Whether to sell the grain at once or hold for higher prices is a question which, like the same one concerning other crops, the farmer must decide for himself. No speculation should be attempted and no risk should be run in hope of a better market. Still, wheat is a standard crop, and, with the exception of temporary gluts, will always be in demand. If the owner can hold it without too great inconvenience it will not be best to sell extremely low unless there is good reason to believe that the depression in price will be permanent. But when a fair price is offered for the crop it is usually better to sell it than to carry it along.

The PLANTED CROPS embrace a larger number than the preceding class. Several of them are of immense value to the growers and hold a high rank among our national productions.

First, in the alphabetical arrangement, we will consider BEANS as a farm crop. Though not very extensively grown for export, large quantities of beans are used by our own people. They

form a very nourishing article of diet, and are among the cheapest kinds of food which the farmer can produce. At the same time they are very easily grown, and can be furnished at a profit for a

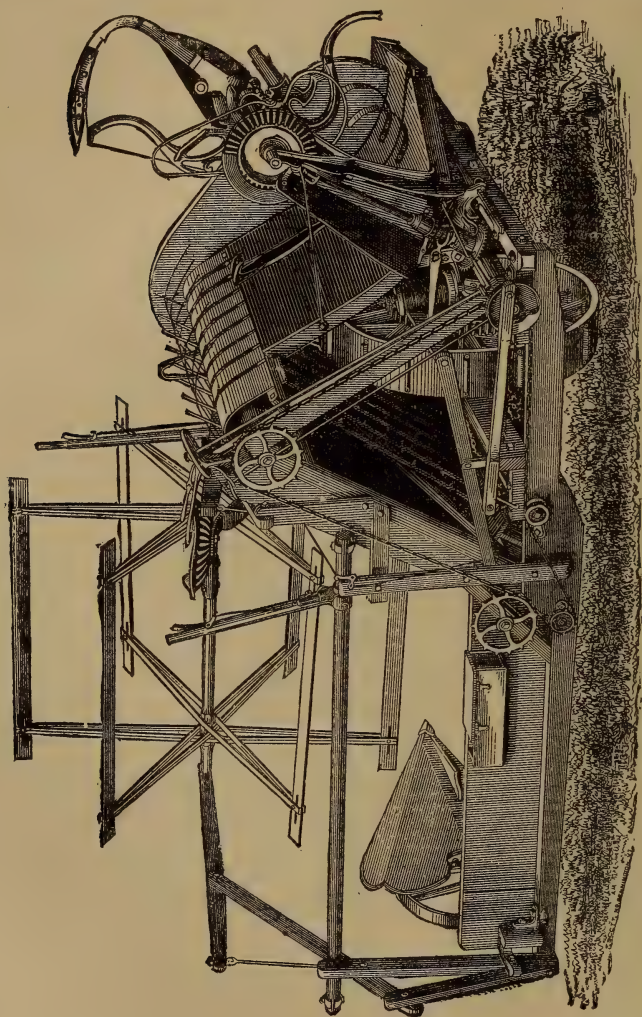


FIG. 19.—WALTER A. WOOD'S SELF-BINDING HARVESTER.

price which makes them one of the best kinds of food for the consumer to obtain. They are the best known substitute for animal food. The kinds of field beans in general cultivation are the small white, the kidney, and the marrow. The former is

very small, ripens early, yields well, and can be kept a long time. The kidney bean is larger and better, but is not as early and does not yield as well. The marrow is a large, round, and very fine-looking bean, of as good quality as any, commands a high price in market, yields pretty well, but requires considerable time in which to mature.

This crop grows the best on a light, warm, or sandy soil, but it can be successfully cultivated on land containing a large quantity of organic matter. On heavy soils it is inclined to run to vines. The same is true, if barn-yard-manure is used. We have applied superphosphate of lime to this crop with excellent results. PROF. STOCKBRIDGE recommends the use of fifty-three pounds of nitrogen, thirty-three pounds of actual potash, and twenty pounds of soluble phosphoric acid per acre, and expects a return of twenty bushels of beans more than the natural yield of the land.

When planted alone, beans may be either in hills or drills. It is an open question which is the best. We have tried both and can grow a good crop in either way. Hills may be one and a half to two feet apart, and eight plants may be left in a hill. Rows should be three feet apart. Drills should be the same distance apart, and the plants must not be too thick. Nearly all the cultivation should be given with a cultivator or horse-hoe. This crop should never be cultivated when wet with either dew or rain. If the vines make an excessive growth, the ends may be cut with sheep-shears, or a sharp corn-knife. We have cut the vines twice in one season. This hastens the maturity of the crop. Beans should not be planted until all danger of frost has passed in the spring, and should be harvested before the slightest frost appears in autumn. Better harvest the crop before it is ripe, than to allow it to be frosted. The plants are usually pulled by hand. All the dirt should be shaken from the roots. If the weather is fine, the vines should be spread on the ground and allowed to dry for two or three days. During this time

they may be turned over, if necessary. If they were nearly ripe, they will soon be ready to go to the barn. If quite green, or the weather is foul, they must be put up in small stacks in the field. These stacks may be made as follows: Set two stakes, each five feet long, in the ground about two and a half feet apart. Between these stakes lay a block of wood, a large stone, or a pumpkin, and upon it lay the beans, with the roots in the centre. When the stakes are three-quarters full, they should be tied with a cord or wire, to prevent spreading apart. Then they may be filled to the top with vines. If beans are well put up in this form, they will dry rapidly. In two weeks the vines may be spread out to the sun a few hours, and then drawn to the barn.

As beans heat very easily, and heating proves a great injury, it is important that they should be very dry when packed away. It is a good plan to spread them thinly on a scaffold, or over the great beams. Or, if well dried before they come to the barn, they may be threshed at once. This should be done with wooden flails. The beans should then be run through a fanning-mill and spread thinly in a dry and moderately cool place. If they have been carefully grown and harvested, they will be very free from imperfect specimens. Still, a few discolored beans will be found in almost every lot. These should be picked out. The work can be done some rainy day, or as odd jobs, when it will not prove a great expense. It will pay well, for a pint of discolored beans in a bushel of nice ones will make the whole lot look badly, and reduce the selling price at least twenty per cent. If the curing will be carefully done, beans may be pulled when quite green. They will be small, but very white, and the vines will make good fodder for sheep. If there is no danger of frost, the crop should be allowed to ripen, but it should never be sacrificed to a frost because it is not fully grown.

This is very often grown as a "stolen crop." We do not recommend the practice, but we sometimes plant beans between the hills of corn. One of our neighbors planted six quarts of

beans in this way last spring, and has harvested about three and a half bushels. The planting cost nothing, as it was done with a machine when the corn was covered. A large part of the cultivation was done by horse-power. The harvesting required but little time, and the actual cost of the beans was very light.

In a few of the central States the castor bean is cultivated to a limited extent. This is a tropical plant, and does not succeed well at the NORTH. It should be grown in rich soils and receive similar cultivation to the corn crop. The plants grow five or six feet high, and yield twenty-five or thirty bushels of beans per acre. This crop can only be made to pay where both climate and soil are favorable, and where there is a mill in the vicinity at which the beans can be used. We have seen the plants growing as curiosities in MASSACHUSETTS and MICHIGAN, and for this use they answered very well. For profit they must be grown farther SOUTH.

BROOM CORN.—This is a variety of the Sorghum, but having been grown for a long period with direct reference to the length and fineness of the seed-bearing stems, and without regard to the sweetness of the juice, its appearance is very different from that of the NORTHERN sugar cane. The culture of this crop was formerly confined almost wholly to NEW ENGLAND, but has now become very extensive at the WEST. In some localities this is a valuable crop. Where the seed ripens well and a good quality of brush can be obtained, the two products are quite profitable. At the extreme NORTH the season is too short to admit of the ripening of the seed. Many Western growers, who make a specialty of the finest brush, do not allow the seed to get ripe. As there is always a demand for the brush, as no substitute has been found therefor, and as it can be grown without great expense, it is a very safe crop for the farmer to produce.

This crop is not confined to any particular kind of soil, and has considerable power of adaptation to different climates.

Any land which is reasonably warm and dry can be made to yield a fair crop. We have seen it growing on a gravel knoll, and also in a reclaimed swamp. It succeeds in the sandy loams of the river bottoms of the older-settled States, and the fertile prairies of the WEST.

Unless the land is quite rich, fertilizers must be used. Any good manure, which is fine and well rotted, will answer. Plaster often proves a great help. Guano is much better. Ashes give good returns. The manure may be applied broadcast if something is used in the hills to give the plants a strong and early start. The preparation of the land should be similar to that which good farmers make for their corn. The rows may be from three to four feet apart. If a large variety is grown, on a rich soil, four feet is near enough. The seed may be scattered along in drills, or planted in hills three feet apart. As the seed is very small and weak, a large quantity is usually put in a hill. Many farmers put in enough to make from seventy-five to a hundred plants. If good seed is obtained, as it always should be, twenty seeds in a hill are enough. The planting should be done when the soil is dry and warm, and all danger of frost has passed. The seed should be put in as soon as the land is prepared, in order that the moisture of the newly cultivated soil may hasten its germination. At the WEST, corn-planting machines and wheat-drills are used for getting in this seed, but in NEW ENGLAND the work is generally done by hand. Two quarts of good seed is sufficient for an acre. If much of the seed is imperfect, a larger quantity should be used. As the young plants are very weak, we consider excessive seeding not only useless and wasteful, but decidedly injurious. The first hoeing should be given when the plants are small, as stirring the soil will tend to promote their growth, and hoeing will also keep down the weeds, which are deadly enemies to this crop while in its early stages. For use in cultivating this crop we consider Prout's Hoeing Machine (Fig. 20), made by the

Belcher & Taylor Agricultural Tool Co., Chicopee Falls, Massachusetts, decidedly the best of anything which we have seen or of which we have been informed. At the first or second hoeing the thinning, which is the worst part of the work of growing this crop, should be done. From four to six stalks should be left in a hill. If in drills, the stalks should be left three or four inches apart. The Dwarf variety will bear rather closer planting than the Early Mohawk, and this can be grown closer than the Missouri Evergreen, which frequently reaches a height of fifteen feet. The crop should be kept clean during the whole season, and will be benefited by an occasional stirring of the soil.



FIG. 20.

The time for harvesting will depend upon the use to be made of the product. If the brush only is wanted, the cutting should be done as soon as the blossoms begin to fall. This will secure brush of a green color. If allowed to stand a few days longer, the brush will have a reddish cast, and will lose somewhat in weight. As the green brush sells much higher than the red, it is an object to secure the crop when it will retain this color. The Dwarf corn is harvested by pulling the brush out of the sheath by which it is surrounded. This must be done with a sharp jerk, and is said to be a very disagreeable operation. The taller kinds are "tabled." This operation "consists in breaking down the stalks of two rows towards one

another, diagonally, so that the stalks of one row will cross those of the other, and thus form a sort of platform or table with the tops projecting about a foot on each side." This is necessary with the tall varieties, as it would be impossible to cut the brush without first bringing it nearer the ground than it grew. The stalks are broken over at a height of about two and a half feet from the ground. Each two rows are tabled in the manner above described, thus leaving a space in which the cutters can work between the tables.

The brush can be cut with a common shoe-knife, and should be laid in small bunches upon the tables. No leaves should be left on and only eight inches of the stalk. If exposed to the sun, the brush will have a tinge of red, even though it may be quite green when cut. Consequently the curing should be done under cover. Exposure also injures the quality of the brush and makes it more liable to break when used. If only a small quantity is produced, it can be cured in a loft over a shed or on a scaffold in the barn. If a large area is grown, a drying house must be built, or some existing structure fitted up for the purpose. The roof should be tight, but many of the boards used for covering the sides should be hung on hinges, so that they can be opened whenever a free circulation of air is desired. The interior of this building should be fitted with a large number of racks upon which the brush can be spread to dry. The floors of these racks should be made of narrow strips of boards, with spaces between, in order to admit the air freely. The brush should be spread very thinly. There should be a space of six or eight inches between these floors. The ventilating doors should be kept open in fine weather, but should always be closed in a storm.

When large quantities of green brush are produced, the seed must be removed before the crop is stored in the drying house. This can be done with a threshing machine by holding the heads to the cylinder, but not allowing the brush to be drawn

through, or by a machine made for this purpose. The seed being undeveloped is of but very little value for anything except manure. If only a little brush is grown, the seed can be taken off by drawing the heads through a "scraper" made of three pieces of flexible iron, about a foot and a half in length, set in a frame of convenient height, spreading a few inches at the top, and coming nearly together at the bottom. This we have found very disagreeable work. As there is something poisonous about the dust and seed, it is extremely bad work for the eyes, and any one having any tendency to inflammation, or any soreness of the eyes, should avoid it altogether.

If the grower does not care for very fine brush, but wishes to obtain a crop of seed, he should not cut the tops until the seed is fully developed. Unless it is very ripe, which in the NORTHERN States it is not likely to be, the brush should dry a while before the seed is removed. Some growers do not separate it until winter. The quality of the brush upon which seed has ripened will not be first-rate, and its appearance will be decidedly inferior, but a good crop of seed is worth considerable for feeding to hogs, cattle and sheep. It should always be mixed with some of the common grains before it is ground. When mixed with corn, it is said to be as nutritious as an equal quantity of oats. As it is liable to heat, it should be thoroughly dried before being put in bins. After the scraping is done, the brush can be bound into convenient sized bundles and stored in a shed, or barn, until wanted for use, or to carry to market.

The quality and profit of this crop depend very much upon the character of the seed. The very best quality of thoroughly ripened seed should be obtained for planting. In growing seed for planting, the highest culture should be given. It should be started early in order that it may get thoroughly ripe, and it should not be grown in the vicinity of the CHINESE sugar cane, Doura corn, or near any other variety of the genuine broom.

corn. As this plant mixes very easily with several somewhat similar productions, it is absolutely necessary for the securing of pure seed that the plants grown for this purpose should be strictly kept by themselves.

COFFEE.—This is a product of warm climates, and in this country can be grown successfully only at the extreme SOUTH. It is said to flourish in the peninsula of FLORIDA. Probably it would succeed in Southern TEXAS and CALIFORNIA. Farmers in these sections may do well to experiment with this crop. The plants should be allowed to attain a height of only five or six feet. By cutting down to this level the production of fruit will be increased, and it can be easily gathered. Plants should stand in rows five feet apart each way, and the land should be kept free from grass and weeds. At three years of age, they should produce fruit; at five, come into full bearing; and for twenty years thereafter, yield two and a half pounds of coffee per plant.

COTTON.—This is one of the most valuable of all of our cultivated plants. It was known in the early ages of the world, and was used to some extent by the ancients. As far back as the commencement of the Christian era cotton was one of the articles of commerce.

The cotton plant is a native of warm climates, and will succeed in no others. INDIA was formerly the principal source of supply, but during the past century the SOUTHERN States have taken the first rank in its production. Early in the history of our country the plant was found growing wild in the MISSISSIPPI VALLEY. Its seed was planted by the early settlers, and it was long cultivated as a garden plant. In 1748 the first export of cotton from this country of which we have either "record or tradition" was made from CHARLESTON, SOUTH CAROLINA. It was a small beginning—only seven bags being sent out, but the business rapidly grew in importance until cotton became the leading crop for export, and brought a hundred and fifty

millions of dollars per year into the SOUTHERN States. It is said that in the early years of its production, a planter once obtained fifteen small bales of cotton from five acres of land, and declared that he had done with cotton, for he had already grown "enough to make stockings for all the people of AMERICA." But his fear of an over-supply proved groundless, and in 1860 the UNITED STATES consumed more than one hundred and thirty-six millions of dollars worth of cotton goods. It has generally been supposed that the amount of cotton produced in this country has greatly diminished since 1859, but recent statistics prove that, with the exception of a single year, three crops grown since 1869 were larger than any three which had been produced before. The culture has been carried on in a different manner. The crop is grown on smaller areas, and by a larger number of planters. But the better culture, the use of manures, the practice of rotating cotton with other crops, and the greater care in selecting the seed, have caused the production of larger crops than the planters themselves supposed could be obtained. This is a very gratifying result. It shows the importance of thorough culture, and proves that cotton can be made not only one of the leading but also one of the most profitable crops which can be grown at the SOUTH.

Although cotton requires a warm climate for its perfection, it is possible to grow it considerably farther NORTH than has yet been attempted on a large scale. In favorable seasons, and when very carefully cultivated in sheltered locations, this crop has been fairly successful as far NORTH as MISSOURI at the WEST and DELAWARE at the EAST. But when grown in these extreme points it is very liable to failure, and its cultivation will not generally prove successful. The cost of growing at the SOUTH will certainly be much less than it will farther NORTH, while in its natural home there is, with anything approaching good cultivation, no danger of failure. We do not think its culture is to be recommended farther NORTH than NORTH CARO-

LINA and TENNESSEE. Even if it could, by dint of the most careful culture, be made to grow fairly a little beyond this line, there are other crops which are suited to the soil and climate which it will pay the farmer a great deal better to produce. Here, as well as in all other things, the man who tries to oppose nature works at a great disadvantage. If the farmer selects crops which are adapted to his surroundings, nature will help him produce them; but if he takes those which belong elsewhere, he will not only have all the difficulties with which the farmer who grows them in their own home has to contend but also the extra labor of overcoming the natural influences which are opposed to their development. PROF. PENDLETON thinks that NORTH of the thirty-fourth degree of latitude the seasons are too short to give uniform success with the cotton-plant, while SOUTH of the thirty-first degree the seasons are so wet and insects so abundant that the cost of culture will be largely increased, while its results must be quite uncertain.

In the tropics cotton is a perennial plant, and, in some places, it becomes a small tree. But in this country it is killed by the frost each winter, and long periods of cultivation have fixed a tendency to produce seeds and staple rather than wood. Here it grows only as an herb, but by good culture it can be made to produce a large number of bolls and yield a large quantity of staple. There are various varieties and sub-varieties of the cotton plant. But the changes caused by difference in climate and cultivation are probably the cause of many of the differences which have now become fixed, and which have made a great deal of trouble for the botanists to classify and describe. Though there is a difference in the color of the seed, and there are many different names, it is probable that whatever superiority one kind of upland cotton may have over another is principally due to more careful culture and greater pains in selecting seed. The SEA ISLAND cotton is, of course, confined to low, moist land, and is not adapted to general cultivation.

But though the natural difference in upland cotton may not be as great as has been supposed, it is a matter of importance for the farmer to obtain the very finest seed which he can secure of some sort which is adapted to the quality of the land which he cultivates. It makes a great difference with the yield and value of the crop whether common seed is used or that from a very prolific kind. We can readily understand why so many farmers have but little faith in improved cotton seed. There have been so many varieties of seed sold for extremely high prices which proved far inferior to the claim made for them, that it is not strange that the advertisement of any new kind of seed is quite generally regarded as a speculation. But we cannot believe that the conclusion to which many growers have arrived that "one kind of seed is as good as another" is correct. On the contrary we assert, both on general principles and also as the lesson of many careful experiments, that the use of the best seed (not always the seed which sells for extravagant prices) will largely increase the quantity and value of the crop. With this, as with all other crops grown from seed, the finest seed, of the best varieties adapted to the circumstances in which they are to be grown, will certainly produce the best paying crop.

If properly managed, the cotton plant will thrive on quite a variety of soils. The best kinds for upland cotton are said to be clay loam and silicious soil on a clay subsoil. On sandy soils, underlaid by sandstone or limestone rocks, and also on rich bottom land, the cotton plant can be made quite productive. Other soils can be made to grow cotton if they are properly treated; but land containing large quantities of vegetable matter which is not thoroughly decomposed, and in which the mineral elements are deficient, is not at all adapted to the crop, and should not be selected for its production.

Cotton has a long tap-root which penetrates the subsoil, if it is not too hard, and draws part of its food therefrom. On this account, deep plowing is one of the essential operations in a

suitable preparation of the soil for this crop. In addition to this, soils lying upon stiff clay also need underdraining. The cotton plant needs moisture, but standing water around its roots proves very destructive. As underdraining will carry off the surplus water, and yet allow the soil to be kept quite moist by the retention of the heavy dews which fall in the SOUTH, it proves of immense advantage to the crop both in wet and dry seasons. When this cannot be given, open drains will prove highly beneficial. In case nothing in the line of draining can be done, the land should be cultivated in ridges, and a water furrow left between each two rows. Though not nearly as valuable as underdraining, this will give some of its advantages, and in a wet season may save the crop from utter destruction.

For uplands which wash badly under heavy rains, and from which much of the manure which is applied is carried off, as well as the most valuable parts of the soil itself, what is called circle-ditching and circle-ploughing has been strongly recommended by the best cotton-growers who have had experience in such locations. It is claimed that by these means lands which have not been spoiled can be kept from injury by washing, while the exhausted soils can be reclaimed. The circle-ditch is made on the principle of a mountain road, which enables the height to be gained by a long and gradual incline. In employing this system of drainage, the lowest point for an outlet must be found. From this a ditch, with a bank of earth firmly laid upon the lower side, and rolled down, should be made which shall gradually wind around the hill in such a manner as to furnish a slight and uniform descent for the water. The ditch may be made by ploughing two or three furrows which should lap over each other, and cleaning out the last one with a hoe. The ridge thus formed should never be disturbed, and in plowing the field the furrows should always follow the curves of the ditch. The rows of cotton should also follow the same direction. In this way the land can be kept from injury

by heavy rains, as the water will have only a slight fall, and the fertilizers which are applied can be used for the benefit of the crop, instead of being washed away.

A great deal of the cotton-land in this country has become very poor under the combined action of repeated croppings and the washing away of the fertilizing elements by the heavy and frequent rains. On this account fertilizers are absolutely necessary to the production of profitable crops on old land, and should be used in the newer fields to prevent the exhaustion which will otherwise be inevitable. For this purpose various articles are used. The quantity to be applied will depend upon the use which is made of the crop. If the stalks, leaves and burrs are left on the land and plowed in, and the seeds are also returned to the soil, so that only the lint is really taken away, the quantity of fertilizer needed will be much less than will be required if the cattle run over the fields in winter and the seed is sold off the farm. But the removal of the lint alone makes it necessary for the farmer to return something in the shape of a fertilizer, or else he will certainly diminish the fertility of his land. As the seed often is removed, the average cotton-grower needs to manure his fields well, in order to keep up his land, and also obtain good crops. The mere removal of the lint exhausts the soil slowly but certainly. When the seed is removed, the exhaustion is about twenty-five times as rapid, and is fully equal to that caused by the growth of corn or wheat. Manure from grain-fed cattle is a first-rate fertilizer for this crop, but a large supply cannot be obtained. Ordinary stable-manure contains all the elements of fertility, and gives good returns. A good compost is also a quite effective fertilizer. Commercial fertilizers are often used with profit. The principal mineral element removed by cotton and which must be supplied by the grower is phosphoric acid. Potash and lime are also removed in small quantities. Organic matter must also be supplied, in the form of nitrogen, to all soils which are badly worn. PROF.

PENDLETON has found, by means of numerous experiments, that nitrogen in connection with soluble phosphate of lime will not only make the worn-out soils productive, but also bring them up, as far as the growth of cotton is concerned, to their original state of fertility. He recommends the use of an ammoniated superphosphate of lime for this crop. Gypsum, bone-dust, and guano are sometimes used with benefit to the crop. But barn-yard-manure, or some fertilizer containing ammonia, phosphoric acid, potash and lime, is probably the best.

The quantity to be applied will depend upon the condition of the land, and whether the seed is removed or not. While it is possible to use more manure than is profitable, the great majority of farmers err in the other direction, and apply too little. The fertilizers should be applied in March, and plowed in deeply if barn-yard-manure is used, and lightly if commercial fertilizers are employed. In the latter case the fertilizer should be covered by a second plowing, as the first one should be quite deep. Or, if preferred, it may be used in the drills instead of being spread over all the land. If this is done, care should be taken to cover it well before the planting is done, or it will destroy the vitality of the seed.

Planting should not be attempted until the land is quite warm. With this, as well as with other crops, there are growers who advocate very early planting, others who plant very late, while many choose an intermediate time. But there seems to be no possible use in planting extremely early. The land must be warm before seeds will grow, and if the soil is too cold and wet, the seed will rot in the ground. On poor land earlier planting is needed than is required on richer soils, or those which are well manured. When the land is rich the planting can be deferred until the middle or twentieth of May, while the poorer soils should be planted a month earlier. The advantage of the late planting consists in a great saving of labor, and a more thorough utilization of the fertilizers. If rich lands

are planted early, they send up large quantities of grass which feed upon the manure, injure the cotton, and require a great deal of work for their removal. Consequently it is better to plant rich soils rather late in the season. But this course must not be attempted with poor land which is not manured, as here the plant grows slowly, and if the seed was planted late, the crop would fail to mature.

The rows should be from two and a half feet apart in poor soils to three feet and a half in rich land. Some growers place the rows still farther apart—from four to six feet in rich bottom soils. The land should be plowed in ridges, so that each row of cotton will stand upon a narrow elevation, with a furrow for the water between each row and its neighbor. These ridges should be thrown up some weeks before the time for planting, in order that the ground may become well settled before the seed is deposited. When the time for planting arrives, the tops of these ridges should be pulverized with a fine harrow, after which they should be opened with a light plow, or some implement which will make a small but clean drill. The seeds should be planted in this drill. If soaked a day or two before planting, and then rolled in gypsum, they will germinate sooner than they will if planted dry.

The distance apart of the hills varies from eight inches to three feet. When the longer distances are chosen, several seeds should be planted in each hill. The seed will be injured by deep covering, but it is of great importance that this and all of the operations of planting should be well done. A machine which would work as perfectly with cotton as some of the corn-planters operate would be of immense advantage to the cotton-grower. Machines which do pretty fair work have been invented, but many growers prefer the certain methods of hand planting. It is very desirable that the rows should be quite straight, and a uniform distance apart, as this will greatly facilitate the after culture of the crop.

The cultivation of the cotton plant has a powerful influence upon its development. About fifteen days after planting, a light plow should be run close to the line of plants. This will tear up grass and weeds. The plow should run only to a moderate depth, and men should follow with hoes, smoothing the earth and cutting between the plants in the rows. If seed is used in the drill as a fertilizer, many of the plants must be cut out. Two weeks later a careful hoeing and thinning should be given. The finest plants should be saved, and all the surplus ones removed. Fresh earth should be drawn around the roots, and all weeds and grass should be removed from the ridges. After this much of the work can be done with plows which should be used frequently, and should always be run shallow. Hand-hoes must be used occasionally, and on no account should weeds or grass be permitted to grow. Good culture is one of the great essentials of success in cotton-growing, and the crop must be hoed often enough to keep it clean. Plowing is sometimes beneficial when there are no weeds, as it promotes the growth, and hastens the development of the plants. Care should be taken not to cut or bruise the plants, as they are very tender, and if injured will not be productive.

The enemies of the cotton plant are of several kinds and often prove very destructive. In the early stages of the growth of the plant the cut worm nips off many of the specimens. A top dressing of ashes mixed with the earth around the roots will sometimes check his depredations.

The cotton louse attacks the plant in its growing state and sucks the juices from the leaves, which turn yellow and drop off. These lice are very small and have many enemies, but being very prolific, they often do a great amount of damage. Planters have sometimes attempted to drive them off by sprinkling poisonous powders upon the leaves, but the labor and expense of treating a whole field in this way is so great as to make it unavailable. The best way to get rid of them is to

encourage the presence of the birds, and of the other insects which prey upon them.

The cotton caterpillar is one of the most destructive of all the enemies of the crop. It is peculiar to this plant and lives only where cotton is produced. It is said that in a single fortnight in 1873 this caterpillar damaged the cotton crop to the amount of twenty millions of dollars. The most effective agent for the destruction of this foe is the Paris green, which is so largely used at the NORTH for killing the Colorado beetle which injures the Irish potato. The green is a violent poison and should be very carefully handled. It should not be allowed to come in contact with the skin, and the dust should never be inhaled. Care should also be taken to keep cattle out of the fields in which it has been used, and the pails and dishes in which it has been placed should never be used for any other purpose. The poison is usually applied dry. It should be mixed with thirty times its weight of flour, or gypsum, and shaken upon the plants from a tin box with small holes punched through the bottom, or from a sieve made for the purpose. The sieve should be fastened to a stick several feet long, so that there shall be no danger that the operator will breathe the dust. It can be shaken over the plant, or a light blow from a short stick held in the right hand will cause enough of the mixture to fall out. A good hand will go over quite a field in a day, and as only a very light dusting is required for each plant, the quantity of poison needed will not be very large. A single pound of the green will be sufficient for several acres. Although this is a cheap and efficient remedy, it is open to the disadvantage of being equally injurious to the friends of the planter as it is to his enemies. Many birds may be destroyed by eating the poisoned worms, and numbers of insects which destroy the caterpillar will also be killed. It may, in bad seasons, be the best method which can be followed, but it is to be hoped that a better one will some time be devised.

The boll worm is an insect foe of the cotton plant which

works upon the small bolls, or buds, causing them to fall off and thus seriously diminishing the rate of production. Various remedies are employed. The easiest, and it is said to be quite effective, is the planting of occasional rows of corn through the field late in the season. The miller which produces the worm prefers corn and will attack it in preference to cotton. Fires are sometimes built at the edges of the field, and in them many millers are destroyed. Sometimes the hands pass through the fields early in the morning and toward night, and with paddles knock the millers off the plants, or catch them in small nets and kill them. Another method of preventing their injuries is to clip off the ends to the branches. As the eggs are generally laid in this position, a great many may be destroyed in this manner. The pruning is said to be beneficial to the plant.

There are several other insect enemies of the cotton plant, but the injuries which they inflict are slight when compared with those which have been named. Thorough culture, liberal manuring, and the multiplication of birds, would be great aids in the work of ridding the cotton plant of all its insect foes.

The diseases which attack the cotton plant are few in number, though often working considerable evil. There is a rust which attacks the plant in the SOUTHERN States, which is similar in its cause and effects to the same disease which proves so destructive to the wheat plant at the NORTH. The parasitical plants fasten themselves upon the stalk, absorb its juices and weaken its vitality. They thus diminish the productiveness of the plants which the owner desires to have grow, and use the food which belongs to them for their own advantage. The remedy for this disease is to be found in the selection of strong-growing sorts, careful culture and liberal manuring. There are several other forms of disease, all coming under the general head of rust, which prove injurious, and sometimes ruinous, to the crops which are affected. They can all be traced to one common cause—the want of suitable plant-food in a condition in which

it can be immediately used. Even the true parasitic affection is due to this cause—the foreign growth absorbs the juices of the plant to such a degree that its health and vigor are sacrificed. The common rust, which appears in the NORTHERN cotton regions, does not appear until some critical time in the life of the plant. As long as there is plenty of food for it in the soil, and rains are frequent but not unusually heavy, all goes along well. But let the fertilizer, or one of its leading elements, become exhausted, or let there be a drought which cuts off the supply of food (which must be in solution in order to be efficient, and which cannot be dissolved in time of drought because there is not sufficient moisture in the soil), or let the quantity of water be excessive, so that the food which the plants need is dissolved in three or four times the quantity which they can use—under any of these circumstances the plant is imperfectly nourished and the rust makes its appearance. The obvious remedies are the application of a liberal quantity of plant-food, thorough drainage of the land, and clean cultivation of the crop. On many of the soils at the SOUTH, which have long been under cultivation, the organic elements are first exhausted. The application of fertilizers rich in nitrogen, the rotation of crops, allowing the land an occasional rest, or the plowing in of green crops for manure, are among the best means which can be employed to prevent the exhaustion of the organic elements in the soil, and thereby prevent the forms of exhaustion or disease of the plants which are known to the growers by the general name of rust.

Not only is it important to devote a great deal of time and labor to the planting and culture of cotton, but there must also be efficient management in securing the crop. As soon as it is ready, the gathering should be commenced. The best hands, and plenty of them, should be engaged in season. It involves a great waste to gather the cotton crop with insufficient, or inexperienced, help. The laborers should be encouraged to gather

the cotton as rapidly as possible, but should always be kindly-treated and well paid for their work. In the early part of the season, when the weather is fine, the work should be pushed as rapidly as possible. The cotton picked when wet with rain or dew should be dried before being packed away, but ought not to be exposed to the sun longer than is necessary.

Preparing the crop for market is also an important part of the cotton-grower's work. If he consults his own interests, the

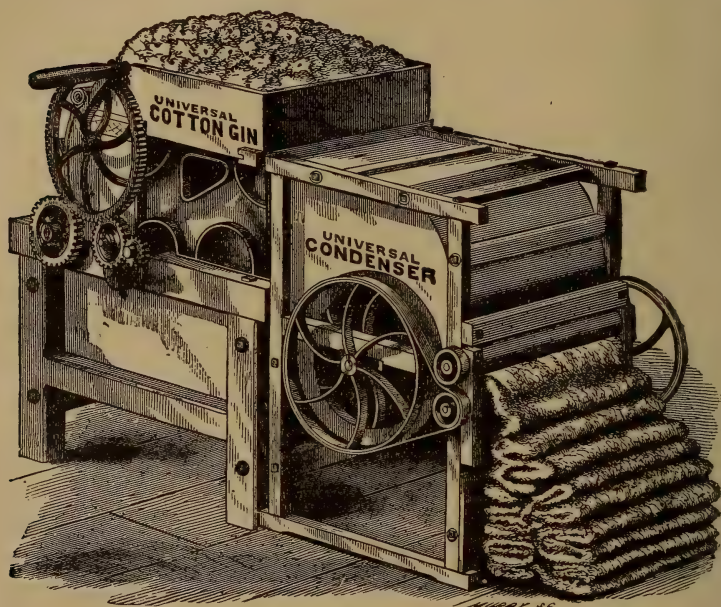


FIG. 21.

planter will see that all the details of this work receive careful attention. Vast sums of money have been lost by SOUTHERN planters by sending off their cotton in poor condition for the market. This seems to be one of the great difficulties with a large class of farmers all over the cotton-growing region, and only loss and evil can result. If a cotton gin is owned, the planter should see that it is put, and kept, in perfect order. Very much depends upon this. Then the cotton must be properly prepared for the ginning process. Ginning cotton,

when it is damp, and feeding in large, tangled masses, are prolific sources of heavy loss. In all cases speed should be secondary to good work. While it is possible to run through eight bales a day, it is better to attempt to clean only from two to four. The cotton should never be fed in faster than it can be nicely cleaned. A good press is one of the necessities of the thrifty planter. He can bale his cotton just as well as the commission merchants, and do it for one-quarter the price which they charge. A press suitable for this purpose will not be very expensive, and will be very useful for many other operations.

We think very highly of the plan recommended by the late JOSEPH B. LYMAN, of LOUISIANA, of building "neighborhood gin-houses in well-chosen locations so as to be central to large farming communities." Here the most perfect gins and presses could be employed, all needed power could be furnished, and the work could be done in the most perfect manner. All the planters in the neighborhood could bring in their cotton and prepare it for the market in the best possible manner and at a much less cost than they could furnish machines themselves. Such a plan would enable many men who have not the means for building expensive gin-houses to grow cotton profitably, would draw in many settlers from the NORTH, and would powerfully tend to develop the material resources of the SOUTH. In Figure 21 we give an illustration of the Universal Cotton Gin, manufactured by R. H. Allen & Co., of New York. Figure 22 represents Dederick's Patent Cotton Press, made by P. K. Dederick & Co., of Albany, N. Y.

When the cotton is ready for the market the grower must decide whether to sell at once or hold it for higher prices. Here his own judgment, enlightened by all the knowledge which he can obtain concerning the state of the market at home and abroad, and the prospects for the future, should be his guide. Still, much will depend upon his financial condition. If he is able to hold his crop, and is confident that prices will go on



FIG. 22.—DEDERICK COTTON PRESS.

lower, while hopeful that they will advance, it may not be best to sell at once. But if he needs money, and must borrow and pay interest until he can sell his cotton, it may be better for him to sell at rather low rates than to wait in hope of a slight advance. As a general rule, to which there are many exceptions, when a crop can be sold for a fair price — a price which will pay all expenses and give a reasonable percentage of profit — it does not pay to hold on for an advance. In no case should the grower be led to engage in any

speculations with his crop. He must not take great risks in the hope of securing great gains. Such a course will not lead to success, but it very often precedes financial ruin.

In addition to the fibre the cotton-grower will have a quantity of seed of which he must make some disposition. This seed has been used for various purposes. The oil has been extracted and sold, the seed has been fed to stock on the farm, large quantities have been ground into meal and sent NORTH for feeding to stock, and many farmers have used it for manure. The circumstances of each grower must have an influence in his decision of the question what to do with the seed. But when we consider the great worth of this material for a general fertilizer, its immense value to return to the fields upon which it was grown, the worn condition of much of the SOUTHERN cotton land and the scarcity of other materials from which to obtain fertilizing elements for the growth of crops, as well as the high price of commercial manures, it seems plain that the best possible use to which many planters can put their cotton-seed is to apply it to the land. We have already shown that the removal of only the fibre exhausts the soil but very little, while the seed carries off the elements of plant-food in considerable quantities. The return of the seed seems to be the best and easiest way in which the land can be made productive, and still remain almost uninjured by the removal of the crops. With cotton, as with all other farm products, the better the condition in which the land is kept the more profitable its cultivation will become. And good culture not only secures large present returns, but also keeps the land from becoming exhausted and provides for the growth of profitable crops in the future.

CORN.—This is considered the most valuable of all of our agricultural productions. The plant belongs to the order of grasses, is a native of AMERICA, was cultivated by the INDIANS, and on this account received the common name of INDIAN CORN. It will grow in any part of the cultivated portions of the UNITED STATES, but finds its most congenial home between the thirty-fifth and forty-second degrees of latitude. It readily

adapts itself to changes of climate and soil. Consequently it is an universal favorite. The value of the corn crop produced in this country in a single year exceeds five hundred and eighty millions of dollars. Large quantities are exported, it is the leading article for fattening pork and beef, and it is used to quite an extent for human food.

Although the corn grown in different parts of the country presents very different appearances, but little care has been taken to keep varieties pure. The consequence is that we have but very little really pure-bred corn. In many of the corn-growing districts the only difference recognized is in the color of the grain, and white corn or yellow corn is called for without regard to any other name. And as it readily mixes with different kinds grown in the vicinity, and also adapts itself to the soil and climate in which it is produced, it is somewhat difficult to keep a variety pure and unchanged when removed from its original home. There are varieties which are very small and ripen very early. In ninety days from the time of planting the seed, the crop may be dry enough to be shelled and ground. If grown in MAINE, or in any of the extreme NORTHERN States, these characteristics will be permanent. But plant this variety of corn a few years at the South and it will lose its present distinguishing features, will grow quite large, and ripen very late. We have often seen these changes going on. Year by year the corn would grow larger and ripen later, until it had perfectly adapted itself to the climate to which it had been taken.

As a general rule the small "flint" corn, with from eight to twelve rows per ear, and ripening very early, is grown only in NEW ENGLAND, northern NEW YORK, MICHIGAN, WISCONSIN, and MINNESOTA. Farther SOUTH the "dent," or gourd-seed, is almost exclusively grown. There are several pretty well-marked varieties of the flint corn which are really valuable, and many others which are more or less distinct, but which cannot be classed as superior. The best of these kinds which we have

seen are the early "YELLOW CANADA," a small eight-rowed variety, the HOLDEN, possessing the same characteristics, but more productive, and KINGSBURY'S EXCELSIOR, an early, yellow, twelve-rowed kind, which makes a larger growth of both stalks and grain than the preceding varieties. The two latter kinds have been long kept very pure, and are fine sorts for the extreme NORTH. Of the large Southern and Western corn there are many kinds. The EARLY GALENA is one of the best for late planting. The WHITE GOURD-SEED, SOUTHERN BIG YELLOW, LONG JOHN, and ILLINOIS YELLOW, are all largely grown. The EVANS, PROCTOR BREAD, and CHESTER COUNTY MAMMOTH are extremely large, and, on rich soil, very productive varieties.

There are, also, many intermediate kinds, which have merely local designations, and which are specially valuable in the belt of country just north of where the large kinds easily ripen, and south of the line above which it is necessary to grow the early ripening kinds. The CONNECTICUT VALLEY CORN and its many variations belong to this class. This is largely grown in CONNECTICUT and MASSACHUSETTS. It is much larger than the early varieties, but smaller than the large gourd-seed sorts. It ripens in about four months from the time of planting, yields a large crop of nice, yellow grain, and a large quantity of stalks which are valuable for fodder. This variety has been tested in the northern part of ILLINOIS, and proved quite valuable. We believe it would pay the farmers of some of the Northern corn-growing States to cultivate the large, yellow corn of MASSACHUSETTS and NEW YORK, instead of the gourd-seed varieties. The quality of this corn is far superior, and the stalks are worth considerable for fodder. DR. NICHOLS claims that a careful analysis shows that a bushel of Northern corn on the cob is equal, for fattening stock, to a bushel of Western corn that is shelled.

The average yield of corn in this country is very far below what it ought to be, and what it might easily be made. OHIO

with all its advantages has only averaged a fraction over thirty-four bushels per acre for the past twenty years, while the estimated average for the country is less than thirty bushels. In some of the States, in which good crops might be grown, the average rate of production runs down to ten bushels. It would be a very easy matter to largely increase this average, and the interests of the farmers would be greatly promoted by such a change. Under favorable circumstances, and with skilful cultivation, immense crops have often been produced. And though practical farmers look with distrust upon reports of excessive yields, and while the truth of many of these reports has not been as fully certified as it should have been if they were strictly true, yet there can be no doubt that more than a hundred and twenty bushels of sound, shelled corn per acre has many times been produced. We have never been able to reach this yield, but we do not live in the best section for the production of the corn crop. We have no doubt that from sixty to eighty bushels of yellow flint corn per acre have been grown by many different farmers, and we have full confidence in the statement of MR. STURTEVANT, of MASSACHUSETTS, that from his thorough bred seed of this variety he has obtained one hundred and twenty-three bushels of sound, shelled corn per acre. There are, also, duly attested reports from BUCKS COUNTY, PA., of a corn crop yielding one hundred and thirty-six bushels, and of another of one hundred and eight bushels per acre. In these instances the large gourd-seed variety was planted. The assertion has been made that two hundred bushels of shelled corn per acre have been grown, but it is the general opinion that this is a highly exaggerated statement. The great majority of first-class farmers find it difficult to obtain one hundred bushels. But the production of the latter quantity should be the aim of every farmer who is favorably situated for growing this crop. The use of first-class seed will do much toward securing this yield, while good land, liberal manuring, and skilful cultivation, will be very

efficient and necessary aids. The best methods of growing seed will be considered in a separate chapter. If good seed is not grown upon the farm, the owner should purchase some of other parties. He cannot afford to use poor or even second-rate seed.

Corn will grow in almost any kind of soil, but will give the best results in one which is warm and rather dry. We have grown it in gravel, and in muck, and in the various intermediate kinds of land. Though it does better in land which is well suited to its wants, no farmer need despair of growing corn on account of the character of his soil. If he can grow any cultivated crop, he can easily fit his land so that it will produce good crops of corn. If extremely wet it should be drained, and if very cold it should be cultivated in ridges. The variety to be grown should be selected with reference to the quality of the land. If the soil is cold, an early ripening kind of corn should be planted. It is one of the great advantages of this crop that by means of careful fitting of the soil, and a skilful selection of the variety, corn can be grown over a vast extent of country, on almost all kinds of land, and under a great diversity of climates and temperatures. It is, when properly grown, less affected by variations of the seasons than almost any other crop. An excess of water is injurious, but seldom proves destructive, while an ordinary drought is borne with comparatively little injury.

The corn plant is a strong feeder, and will make use of almost any kind of plant-food. Decomposed barn-yard-manure, hog-manure, and sheep-dung are especially valuable. On some soils plaster proves very beneficial. Ashes are excellent for this crop. Chemical fertilizers, either the special formulæ for corn or the complete manure, are almost sure to give good results. The quantity of manure to be applied per acre depends upon many circumstances. With a little manure some corn can be obtained from almost any soil. But the crop can utilize a large amount of food, and the more liberal the application of manure, up to a point which but few farmers reach, the larger will be the

crop. Here the farmer who uses only barn-yard-manure is very liable to make a mistake. He finds that a moderate application of manure not only secures the growth of a fair crop of corn, but also that the effect of the manure is visible for three or four of the succeeding years. The crops which follow the corn are considerably larger than they would have been if the land had not been plowed. Consequently, the farmer concludes that he has applied more manure than the corn required, and that it is this excess which stimulates and feeds the succeeding crops. But this is an error. The corn would have used more food if it could have obtained it in a suitable form, but much of the manure did not get into an available condition until long after the crop was removed. It should always be remembered in deciding the quantity of manure to be used on corn land that the ordinary grades of this fertilizer contain much plant-food which will not be in a condition to use the first season, and that, on this account, an extra quantity should be applied, or else some commercial fertilizer should be used in connection with the manure from the yard. Many farmers use only twelve two-horse loads of compost per acre, while some of their more successful neighbors apply from twenty to forty such loads of a much better quality of manure.

The method of its application will have some influence in determining the quantity of fertilizer to be used. When the NEW ENGLAND method of putting the manure in the hill is followed, a less quantity will do than will be needed if applied broadcast. Except for very poor land it is much better to spread the manure over the whole surface of the ground. Corn roots go a long distance in search of food, and it is not wise to put all the manure directly under the plant. When a liberal quantity of manure is spread on the surface and worked in to a depth of a few inches, and a small quantity of manure, or commercial fertilizer, is used in the hill in addition, the best results will be obtained. But, on account of the great amount of labor

involved, this is generally considered impracticable. When the planting is done by hand it is best to, at least, throw a handful of plaster and ashes in each hill. This will give the corn a strong and early start, and keep it growing until the roots reach the manure which has been plowed or harrowed in. When fertilizers are used in the hills they should be slightly covered before the seed is dropped. Some corn-planting machines have an arrangement for dropping plaster, or other fertilizer, near the seed.

It is, in some sections, a very common method to spread the manure upon the land before it is plowed. On dry, light land, which is only plowed four or five inches deep, this will give good crops if a fertilizer is used in the hills. But if nothing else is done, the plowing in of a broadcast application is not a good way in which to feed the crop. If spread upon a heavy sod, and we have often seen this done, and the plow run quite deep, the corn will obtain but very little, if any, benefit from the manure. Succeeding crops may be benefited, but for immediate use the manure is not available. Even when the plowing is quite shallow, we do not believe it pays to put the manure in the bottoms of the furrows and cover it with sods. We consider it much the best way to spread manure upon the surface after the land has been plowed and work it in with a harrow. If the manure is fine, it can easily be got in with a common square harrow. If it is coarse and strawy, a wheel-harrow will answer the double purpose of fining the manure and pulverizing the soil. If chemical manures are used, they are to be sowed broadcast and harrowed in, except the fertilizers which are made specially for use in hills or drills.

The following is a good method for manuring corn. If sod land is to be planted, a liberal application of stable manure should be made after the land has been plowed. This should be thoroughly harrowed in. A light application of some special fertilizer for corn should then be made and covered with a har-

row. In the hills or drills a small quantity of ashes and plaster, or some other quickly acting fertilizer, should also be used. If stubble land is to be planted, a liberal quantity of manure may be plowed in, not more than five or six inches deep, and the commercial fertilizer used as recommended above. But if only a small quantity of manure can be had, and the farmer does not choose to buy commercial fertilizers, the land should be plowed and harrowed, the rows marked with a small plow, and the manure placed in hills or scattered along in the drills. If put in drills, the manure can be covered by turning back the furrow which was laid out, and the corn may then be planted with a one-horse machine. But when manure is used in this manner the planting is usually done by hand.

The seed should never come in contact with the manure. When thoroughly decomposed material is used, this rule is often disregarded. But it is better that the fertilizer should be covered with a little fresh earth. This in order that the natural moisture of the land may hasten the growth of the seed, and also to prevent all possibility of injury to the germ by heating of the manure. It is not safe to plant directly in unfermented material, while a bed of well-rotted manure is not a good place in which to start the corn plants. When corn is planted on very wet land which is imperfectly drained, the manure should be put in hills, or drills, in order to elevate part of the roots of the plants above the ordinary level of the soil. But it is much better to drain the land, or even to plow it in ridges, than it is to build up the hills.

The time for planting varies with the location and with the character of the season. In an ordinary year the planting of this crop in the SOUTH is best done in March; in the MIDDLE STATES, and those in the same latitude, from the first to the middle of May; in MASSACHUSETTS, and the States with a similar climate, from the tenth to the last of May; while at the extreme NORTH, the corn is not planted until June. In some



FIG. 23.—NEW YORK CORN AND SEED-PLANTER. MANUFACTURED BY N. Y. PLOW CO., NEW YORK CITY.

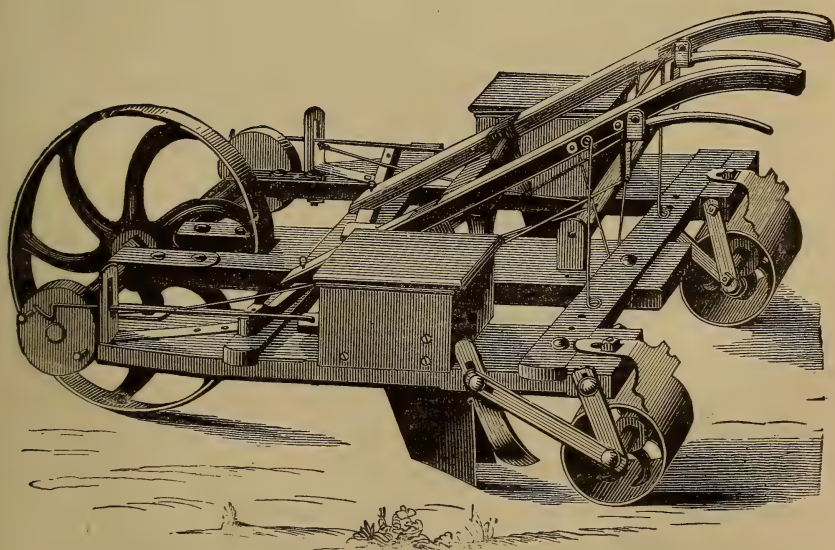


FIG. 24.—DOUBLE ROW CORN-PLANTER. MANUFACTURED BY A. B. FARQUHAR, YORK, PA.

seasons the seed can be safely planted a week or ten days earlier than the usual time, while in other years, which are cold and wet, the work must be delayed until the weather and temperature are favorable. There is not the slightest use in putting in corn long before the ground is dry and warm. The seed cannot grow until the ground is warm; and if planted sooner it is liable to decay. But it is well to do this work promptly when a suitable time arrives. Early planting, if not too early, will usually give better crops than late planting. There is the additional advantage of having the corn large enough to cultivate before the time for haying arrives. At the NORTH, early ripening is desirable in order that both grain and fodder may escape injury by frost; and this must be secured, if at all, by early planting, or else by the use of a very early variety. We have known farmers to put in their corn so late that the plants did not get large enough to hoe until time for their grass to be cut. Then they were under the necessity of either neglecting their hoeing or their haying. The result has usually been that their corn became very weedy and their grass got over-ripe. A light crop of corn and a damaged crop of hay can often be traced to late planting of the corn. Figures 23 and 24 represent some excellent planting machines.

Whether the planting should be done in hills, or in drills, is a question upon which there is a difference of opinion. A great many practical farmers favor the old method of putting the seed in hills, while others consider the newer method of drilling an improvement. When it is done in squares, hill-planting allows the corn to be cultivated both ways. This is certainly an advantage. But when the corn is grown in drills, the plants are more evenly distributed over the ground, all crowding is avoided, and the sun and the air have free access to them. The advocates of drill-culture claim that these benefits more than offset the gain secured by running the cultivator both ways when the planting is done in hills. Figures 25 and 26 show



FIG. 25.—CORN DRILLED OR PLANTED, 9 IN. APART.



FIG. 26.—CORN IN HILLS.

the relative appearance of corn grown by these methods. Many of the best planting machines can be adjusted to drop the seed either in hills or in drills.

In order to be highly successful with the corn crop, the farmer must give it frequent and thorough cultivation. Whether it should receive level culture or be hilled will depend upon the character of the land and of the fertilizers which were used. On dry land we believe in keeping the surface as nearly level as possible. On wet land it is almost always best to make the hills a little higher than the surrounding level, and when coarse manure is used in the hills, it is necessary to make them of considerable size. With these exceptions we much prefer level culture.

The first cultivation of the crop should be given when the plants are quite small. This for the double purpose of checking the growth of the weeds which have started and promoting the growth of the crop. We do not favor the old-fashioned method of hand-

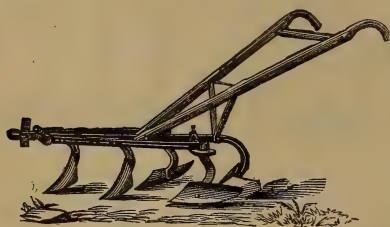


FIG. 27.

hoeing, which is still largely practiced in NEW ENGLAND. It does not pay. With a good cultivator more real benefit is conferred upon the crop, and the cost of the work is much less than that of hand-hoeing. Prout's Hoeing Machine has already been noticed as an excellent implement. In Figure 27 we give an illustration of Allen's Planet Jr. Horse-Hoe. This simple, cheap, yet effective implement is made by S. L. Allen & Co., of Philadelphia. Figure 28 represents the Garden City Riding or Walking Cultivator, made by the Furst & Bradley Manufacturing Co., of Chicago. Figure 29 illustrates the Improved Corn Harrow, manufactured by the Warrior Mower Co., of Little Falls, N. Y. Either of these implements can be made to do almost all the work which it is necessary to perform.

A hand-hoe would be a little nicer, but hand-work is too costly. After the first hoeing, the corn may be cultivated with profit once a week until the tassels are out. The latter part of the time the cultivator should not run very close to the hills. Neither should the culture be very deep. By way of experiment it may be well, on a small part of the field, to disregard the last suggestion and try the effect of root-pruning. By plowing out a small lot of corn when it is in the silk, letting the plow run deeply, the crop *may* be greatly increased. It will pay to give this plan a trial.



FIG. 28.

HARVESTING.—Various methods are employed. The **NEW ENGLAND** method requires considerable time, but it enables the farmer to secure his crop in the best condition. When the kernels are thoroughly glazed (if there is danger of frost it is done sooner) the corn is cut at the roots, bound in bundles containing the stalks of from twelve to sixteen hills, and from six to ten bundles are set up in a stack. The tops of the stacks are firmly tied and the corn left in the field a few weeks to cure. Some farmers tie the tops of a couple of hills together, cut and set up a dozen hills around them and tie the whole at the top.

After these stacks have dried a while, the centre hills are cut and the whole stacks taken to the barn, or else husked in the field. By following either of these plans the fodder is all saved, and the grain is secured in the best possible condition.

The old method of topping the corn has been pretty generally abandoned. It has been found that after the tops and leaves are removed there can be no farther elaboration of plant-food, and that the grain does not improve. But if the plants are cut at

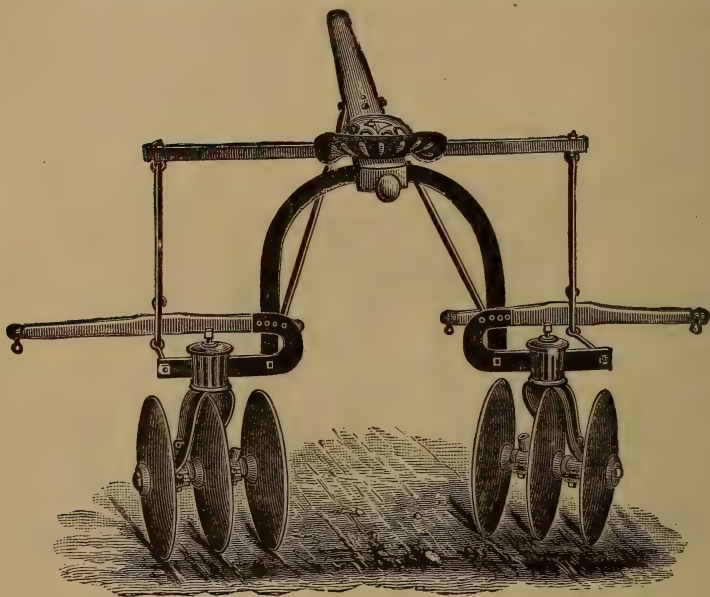


FIG. 29.

the roots before the grain is ripe, the sap in the stalks will carry on the ripening process to some extent.

Many farmers at the WEST are now making an effort to save their corn-fodder. The OHIO FARMER has done good service in calling the attention of its readers to the fact that this fodder is quite valuable and ought to be saved. Other papers have taken the same position, and many of the best farmers have found that they cannot afford to waste this excellent material for stock-food. The method, so long practiced at the WEST, of merely gathering

the ears of corn, and leaving the stalks to be trampled down by the cattle, to be burned, or plowed in, will not much longer be very generally followed. At least part of the fodder should be saved on every farm. When the stalks are not gathered they should not be burned, but cut and plowed into the land. They will be worth something as plant-food for the succeeding crop. Figure 30 represents a machine, with a roller attachment, for cutting stalks and getting them out of the way of the plow. It is made by the Eureka Manufacturing Co., of Rock Falls, Ill. When the stalks are to be fed, the harvesting of the crops should be done as soon as the corn is fully ripe. The grain will be just as good, and the fodder much better than it will be if the plants stand too long.

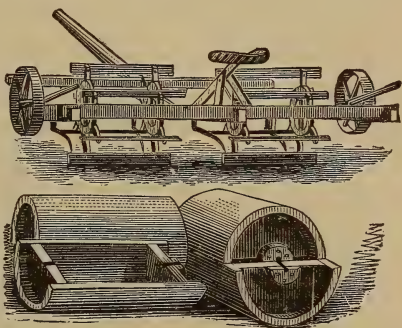


FIG. 30.—EUREKA DOUBLE-ROW STALK-CUTTER.

When the stalks are well dried, the corn should be husked, the ears stored in suitable bins, or cribs, and the fodder stacked near the yards, or packed away in a barn or a spare shed. The corn should not be shelled and measured for at least three months after it is ripe. Careful experiments have proved that corn shrinks, both in weight and measure, for several months after it is husked. In one instance in which corn was weighed and measured in November and again the succeeding August, the last trial indicated a loss of eighteen and six-tenths per cent. in bulk, and twenty-two and six-tenths per cent. in weight. Corn is usually considered merchantable the first of January, and is often sold earlier in the season; but it continues to lose both weight and bulk until April or May. The farmer who sells his corn early saves quite a loss in this respect.

This crop is subject to the attacks of worms of various kinds,

The cut-worm works when the plants are only a few inches high. He cuts the stalks off near the surface of the ground. We have found this worm more destructive on sod-land than on stubble. When but little corn is grown, these worms can be dug out of the hills in which there are indications that they are at work. When large crops are produced, it has been suggested that a pair of old wheels be fitted with projections on the rims, which will make holes four inches deep when the wheels are run upon the land. The worms will attempt to follow the smooth tracks made by the rims of the wheels, fall into the holes, and be destroyed by the hot sun. It is a wise course to build bonfires near the corn fields in the evenings of summer in order to destroy the insects which produce these worms.

Wire-worms are often quite destructive. They usually do the most harm when the plants are small, but they sometimes keep working until the crop is fully matured. Various preparations have been recommended for use in the hills, but we know of nothing effectual which can be used on a large scale. Where only a very little corn is grown, a piece of potato may be put in each hill, examined daily, and the worms which have entered be destroyed. This is a method in use to some extent in ENGLAND. It is said that if a piece of cob is placed in each hill the worms will enter the pith and can be killed. A mixture of equal parts of plaster and ashes, the whole to be saturated with night-soil, and half a pint placed in the bottom of each hill, has been highly recommended. This would make it necessary to plant the corn by hand, and would not, on this account, be applicable to large fields. We have but little faith in anything of this kind. As far as our experience goes, it is of but little use to try to fight the worms in this way. They are hardy creatures, and not easily disgusted with their surroundings. Anything which will kill them will also kill the corn, and they are not readily frightened away. As they work most where the land is wet and cold, the best method of

defeating them seems to be by thorough draining of the soil, making the land as light and warm as possible, and in using fertilizers which will give the plants a quick start and a rapid growth. Plowing in the fall also proves useful in the NORTHERN and MIDDLE STATES by subjecting a great many worms to a degree of cold which will destroy them.

The diseases of corn are not numerous, and are not usually very destructive. The yellows is a sort of disease caused by an excess of water in the soil. The corn cannot grow because there is so much water around the roots. The plants turn a yellow, sickly color, and will not thrive until the land becomes drier. This disease can be wholly prevented by draining the land, or partially by cultivating it in ridges.

The smut is a fungoid disease which in some seasons, especially those which are very warm and wet, destroys many of the ears of corn. It has been suggested that sowing salt upon the soil before planting would be the means of partially preventing this disease. As the loss from this source is not very great, but little effort has been made to find either a cause or remedy for the disease. Good culture, high manuring, and a judicious rotation, so that corn shall not be planted on the same land more than two successive years, will be almost sure to secure a large crop in spite of any and all attacks of this disease.

In some sections the birds cause considerable injury to the corn crop. The crows and blackbirds will sometimes pull the plants when they are only a few inches high, in order to obtain the kernels. The latter also occasionally attack a field when the corn is in the milk and work a great injury. When the grain is ripe, and from that time until it is taken from the field, these and other classes of birds often do a great deal of harm. The blackbird destroys the eggs and young of many better birds, and should be kept in check, if possible. But the crow is a very useful bird, and should be frightened rather than killed. Coating the seed-corn with coal-tar will usually prevent birds

from pulling the plants. If the work is done early, the corn can be planted with a machine. We put from four to six quarts of corn in a leaky pail, turn on some warm water, and stir the corn thoroughly. When all of the kernels are wet we drain off the surplus water, dip a stick into a dish of tar and with it stir the corn again. Only a very little tar is needed to cover the corn well. A quart of tar will cover several bushels of corn. After it is coated with the tar, the corn is spread in the sun. When it is nearly dry, it is spread under cover and left until wanted for use. Corn treated in this way can be planted in a machine just as well as it could if it had not been tarred. Corn which is to be planted at once may be covered with tar and then rolled in plaster. If planted with a machine, the slides must be open farther than usual, as it will not drop freely.

In order to prevent depredations later in the season, and some growers take this course to prevent the pulling of the corn, "scarecrows" are often erected in the fields. Images of various kinds frequently prove effective with crows, but the blackbirds are not as easily frightened. Small pieces of polished tin, suspended from a pole by a string, are very good. Pieces of looking-glass, hung in the same way, are still more efficient and will be likely to keep all birds from the corn.

On small farms the husking is done by hand. It should be attended to early in the season. This, because the work can be much more easily and rapidly performed in warm weather than it can in cold days, and also in order that the corn and fodder may not be too long exposed to the sunshine and storms. Where large quantities are grown, a machine for husking, or one for shelling ears which have not been husked, will be found a great convenience, and will save much time and a great deal of hard work.

Before feeding, corn should be shelled and ground. This is a much more economical way than it is to feed it on the ear. Many farmers are in the habit of having both corn and cobs

ground. This saves shelling, and many feeders say that it greatly improves the quality of the meal. Other men, of equal intelligence, consider the cob worthless, and sometimes injurious, for food. We have never found it profitable, though we have sometimes tried the experiment, to feed cob-meal. We believe that the cob contains but little nutritive matter, that it is almost impossible to grind corn and cobs together as finely as they should be, that for young stock the cobs are liable to cause irritation of the digestive organs, and that for a fattening animal so large a quantity of the mixture is needed that the stomach will be unduly distended and overloaded. In order to fatten an animal rapidly, very rich food is required. If it is desired to carry on the fattening process slowly, a small quantity of meal should be given. It is quite expensive hiring the cobs ground. We consider them worth more to put in the hog-yards for manure than they are to grind into meal. They are also good for fuel, though it is said they are injurious to the stoves in which they are burned. As they contain considerable potash they are quite valuable for manure, and ought, in some form, to be saved and returned to the land.

The stalk crop is of such importance that it should be considered in this connection. We are strongly in favor of growing corn for feeding both in a green and a dry state. For green food in the summer, corn is one of the best crops which can be grown. For drying for use in cold weather, it is almost equally valuable. We prefer the sweet corn for this purpose. It is not as large as some kinds, but, if properly grown, the cattle will eat quite a proportion of the stalks. There is not half the waste to this fodder that there is to the gourd-seed varieties. We plant in drills, with a machine, three feet apart. Not more than ten or twelve kernels per foot should be dropped. Thicker planting will make more fodder, but the quality will be much poorer. As soon as the plants are two or three inches high, a cultivator should be run close to the rows. During the

season the crop should be cultivated several times. When two feet high it will do to feed green. That which is to be dried should be allowed to stand until the kernels on the ears are well formed. It should always be cut before a frost. It should dry a day or two, and then be bound in small bundles and set up in small stacks. These should remain until well dried. Then the bundles should be set out in the sun a few hours, after which they may be drawn to the barn or stacked near the yards. If the land is good, and a fair quantity of manure has been used, a large amount of very good fodder will be secured. Broadcast sowing will give double the quantity, but the quality will not be as good. Almost every farmer who keeps stock can make it pay to grow this crop every year. The ENSILAGE of corn fodder, by means of which the stalks can be kept fresh and green for an indefinite time, will be considered in a separate chapter.

HOPS.—The hop is a perennial plant which sends up a long, twining stem, and bears its fruit in clusters. The stem is killed by frost, but another grows the succeeding year. The fruit is useful in medicine as a tonic, and it probably possesses a narcotic property. Hops wet in warm water are among the most efficient remedies for that terrible disease, neuralgia. We have used them for this purpose with great success. Nervous, wakeful people often derive great benefit from sleeping on a pillow made of hops. But the great use of hops is for making beer. On account of this perversion they prove an injury to the human race. But they are so extremely valuable for use in cases of neuralgia, for making yeast, and other household purposes, we have concluded to give brief directions for growing them on a small scale and for home use.

Any good corn soil will grow good hops. If very wet, the land should be underdrained. If not, rich well-rotted compost should be applied. Lime is often a valuable fertilizer for this crop. If the land is very stony, it should be cleared of these obstructions before a plantation is started. A location sheltered

from strong and cold winds should be chosen. The plowing should be done in the fall, and should be quite deep. In spring manure should be applied and harrowed in. The surface should be made very mellow, marked out in squares with the rows perfectly straight, and at a distance of eight feet apart. Between these rows corn or potatoes may be grown the first season. The underground runners from old vines are used for planting. About two bushels of good trimmed sets will be needed for an acre. The runners should be cut into slips, each containing two or three buds, and kept moist until wanted for planting. The runners from the male and female plants should be kept separate. Only eight or ten of the former will be needed on an acre. Four slips may be put in a hill. They should be covered from two to three inches deep with fine soil. Many growers put a shovelful of compost manure in each hill before planting, while others make the land rich enough by spreading fertilizers on the surface. If the land is dry, the latter course is preferable. If rather wet land is used, manuring in the hills will be a benefit.

During the first year some growers cultivate sufficiently to keep down the weeds, but they do not set the poles, and they make no effort to obtain a crop until the second season. Others put up the stakes, and secure a partial crop the first year. When the latter plan is followed, poles eight feet long should be used. They should be set one foot in the ground. All the vines in a hill should run upon one pole. Good cultivation should be given. Poles for permanent use may be from eighteen to thirty feet long. Various kinds of wood are used. Cedar are the most durable, but are quite costly. Poles are apt to be blown down or broken off by the wind, and thus injure the crop. On this account horizontal yards are preferred by many growers. One stake is set at each hill. These stakes are sawed an inch and a quarter square, nine feet long, and covered with coal tar. A row of stakes should be set eight feet outside

of the hills all around the field. The tops of all the stakes are connected with strong, tarred twine. At the male hills poles eighteen or twenty feet long should be used, so that the wind can blow the pollen over the whole plantation. The horizontal method is much cheaper than the use of long poles: the hops grow better, and the crop is gathered with less work.

When the vines get two or three feet long, they must be tied to the poles or stakes. Frequent cultivation should be given, and no weeds should be allowed in or near the hills. As the vines grow they will need tying occasionally to the stakes, and, if the horizontal method is employed, when they get a little above the top they must be laid on and wound around the strings. If small poles are used, two may be set in each hill, but about fifteen inches apart. In the fall a shovelful of well-rotted manure is to be thrown upon each hill. In the spring this is carefully hoed away, the root-stocks are cut off, and saved for use or sale, and the old vines should be trimmed off above the sprouts with a sharp knife. If any grubs are in the hills, they should be got out and destroyed. After cultivation should be sufficient to keep the field clean. It is not well to hoe this crop when in blossom, but no injury will result from hoeing after the hops are set.

As soon as the seed becomes hard and its color changes to purple the hops are ripe, and picking may be commenced at once. When the horizontal plan is pursued, the hops can be picked directly from the vines. If grown by the other system the vines are cut with a sharp knife, the poles taken up and laid over a box at which two or four pickers work. The hops should be picked off clean and no leaves, or pieces of the vines, should go with them into the box. Some growers cut the vines from three to five feet from the ground. Others cut them closer. When the boxes are full the hops are shovelled into sacks and carried to the kiln. If only a small quantity of hops are grown, the drying can be done in a store-room, or any convenient place.

But when this crop is grown on a large scale a kiln will be required. The hops should not be packed until they are thoroughly dried, and if dried in a kiln they must also be allowed to cool. When thoroughly dry and cool they may be put into sacks, pressed, and stored or sold.

ONIONS.—Although at the SOUTH onions cannot be grown from the seed in one season, but must have two years in which to mature, the great value of the crop at the NORTH and WEST gives it a strong claim upon our consideration and an honorable position among the products of the farm. Though largely grown by market gardeners, there are many farmers who make this crop a specialty, and many more who choose it as one of their principal money crops. At the SOUTH it is a quite common custom to grow this crop from sets. The hot summer prematurely checks the growth of the plant started from Southern seed, and the stalk dies down long before the plant has attained its normal size. The bulbs which are thus formed are very small and of no value for the table, but if set out the next spring they will grow into onions of a fair size and passable quality. They ripen earlier than onions grown directly from the seed, and on this account the first year's growth, or sets, are in demand at the NORTH for use instead of seed by growers who desire to supply the market very early in the season. The onions grown in this way are not as good keepers as those which are secured from seed, and this method is not recommended except for those who want a very early crop. SOUTHERN grown sets are much better than those which are produced at the NORTH. It has recently been proved that seed grown far NORTH will, under favorable conditions, mature a crop at the SOUTH the first season, but this result cannot be attained with native seed.

To grow good sets the land should be plowed, lightly manured, the surface made very fine and smooth, and the seed sowed early in the spring in drills ten inches apart. These drills should be broad and shallow, and seed should be used at the

rate of thirty pounds per acre. When the crop is mature, the onions must be pulled, cured, and then stored in a cool and well-ventilated loft. The next spring these sets are put out, in rich land, in rows ten or twelve inches apart and two or three inches apart in the row. They should be lightly covered, and, during the season, should receive sufficient cultivation to keep down all the weeds. The farmer who lives near a large city may be able to work off some onions of this class, but in small villages they do not sell in any except very small quantities and we do not consider it an object for those who must depend upon such markets to attempt their cultivation.

The Rareripe is another form of the onion, though often mistaken for the set. This is still less desirable than the set, and its production is not to be generally commended. It is merely a mature onion which has been kept through one winter and is ready to devote its energies to the production of seed. If kept from seeding, the bulb will increase in size. Many farmers keep their very small onions for use in this way. Large onions which have become badly sprouted also answer the same purpose. The small ones grow to a much larger size, and, in common with the large ones, send up seed stalks. These should be cut off as soon as the swelled growth is exhibited and just below where the stalk begins to enlarge. The plants should be kept free from weeds, and, with the exception of requiring a little more room when large specimens are used, are to be treated in the same manner as a crop grown from sets. These onions will mature early, but are not very good.

The Potato onion is a variety which multiplies in the soil. This kind is easily grown, but is too poor to become a general favorite.

The Shallot is similar to the Potato onion, but better in quality and an extra keeper. The bulb which is planted divides into several irregular-shaped onions which never attain a large size.

Top onions are large, coarse, and decidedly poor. They are

very poor keepers, but as they are early, have a very mild flavor, and are easily grown, they are more common than their actual merits would lead one to expect. They are propagated by little bulbs, which, sometimes to the number of a dozen, grow on top of a seed stalk. They grow in the same place and way as the ordinary seeds, but are miniature onions instead of black seeds. These bulbs are to be gathered when ripe and spread in a cool place. Early in the spring they may be put out in rows from ten to fourteen inches apart and cultivated enough to keep them free from weeds.

We now come to a consideration of *the* genuine onion in its best form. This is grown from the black seed which is produced in a sort of head on top of a tall stalk which is thrown up during the second year of the life of the bulb. The quality of the seed which is used will have a very strong influence upon the yield and quality of the crop which will be obtained. Many growers of onion seed use for this purpose an inferior lot of bulbs. Often those which are badly formed, or are too small to sell, are used for seed stock. A few growers select the finest bulbs and grow seed therefrom. Seed from the best stock is the only kind which should ever be used. A difference of hundreds of bushels per acre is often made in the yield of a crop simply by the quality of the seed. It is not only necessary to secure seed from good stock, but it is of great importance that it should be fresh. Seed three years old is good for nothing, and at two years of age but a very small proportion of ordinary seed will germinate. If very carefully kept, perhaps one-half of a lot of strictly first-class seed will grow when two years old, but even then there is a great deal of risk. Consequently, it is much better to obtain new seed than to place the slightest dependence upon that which is old. It is a great damage to be obliged to plant over, and the grower can better afford to pay double price for good seed than to go through this operation, even though the seed for his first sowing costs him nothing.

Early sowing is one of the essentials of success with this crop. The onion land should be plowed and got in condition for sowing as early in the season as possible. The best soil for onions is neither very heavy nor very light; is not too dry, and is far from being wet. A sandy or gravelly loam will generally give good crops, but many other kinds of land will yield pretty well. Unlike most crops, onions do better, and it is much less work to grow them, when planted on the same land year after year. It is a good plan to grow carrots on the proposed onion-bed as a sort of preparatory crop. When onions are to be grown, a liberal application of first-rate manure should be made. Well-rotted stable-manure, hog-manure, or night-soil, will give good results if freely used. As a general thing farmers do not make their land rich enough to give the best results with this crop. It is a strong feeder, and must be well fed in order to be made profitable. The manure should be extremely fine, and should be plowed in to a depth of four or five inches. Not less than eight cords of strictly first-class manure should be used on an acre. After the land has been plowed, it must be rolled if it is inclined to be lumpy, and then harrowed. If the soil is reasonably fine, the rolling may be omitted. Wood-ashes at the rate of from one to two hundred bushels per acre, or a liberal quantity of some special onion fertilizer, should be sown and harrowed in. If there are any stones on the surface, they must be removed. After the harrowing, the land must be carefully raked with a fine-toothed hand-rake. This in order to get out small stones, and crush or remove any lumps of earth which may remain. It is considerable work to fit an onion-bed to receive the seed, but it is very important that this work should be faithfully performed. The yield of the crop largely depends upon the manner in which this preparation is made, and the labor attending its after cultivation will be modified thereby in a still greater degree. An extra day's work on one-eighth of an acre of land before sowing may

save several days' time afterwards, and will certainly save a great deal of very hard labor. Until the surface soil is light and fine as ashes, do not be tempted to think that it will "do well enough." It will not be well enough until the land is perfectly fitted.

When this stage is reached, the seed should be sown. The quantity required will be from three to four pounds per acre, if the seed is perfect; and from four to five pounds if it is almost, but not quite, first-class. If the rows are only twelve inches apart, of course more seed will be needed than will be required if the spaces are eighteen inches wide. We think sixteen inches is far enough apart, and do not believe that it is well to put the rows nearer together. For sowing, a machine of some kind should always be used. It takes a great while to sow onion seed by hand, and in the effort to sow in this way quite a proportion of it is wasted. There are machines made for this special purpose, which cost only a few dollars and do the work perfectly. But it is better to obtain a combined drill and hoe. With this machine not only the sowing but also a large part of the cultivation of the crop can be done. If but a small quantity of onions are grown, a few neighbors can buy one of these drills in company, and thus make the individual expense very light. After the seed is sown a light hand-roller may be run over the land. Most seed-drills have a roller which passes over the row, and when they are used this operation is unnecessary. Figure 31 represents the celebrated Planet Jr. Garden-Drill, Wheel-Hoe, Wheel-Cultivator and Wheel-Plow combined. It is made by S. L. Allen & Co., of Philadelphia. We have used one of these implements several years, and found it first-rate for each of the various kinds of work which it is intended to perform.

It is never well to grow this crop on weedy soil. If the proposed onion bed is weedy, it is better to grow carrots, or even corn, upon it until the weeds are rooted out. But whatever the character of the land in this respect there will be weeds

enough, and they will make their appearance very soon after the land is worked. Just as soon as the rows can be plainly seen, a wheel-hoe should be run between them. This will benefit the crop, and destroy a multitude of weeds.

If only a small business in this line is attempted, the combined machine, shown in Figure 31, will answer every purpose. But where onions are extensively grown, the Planet Jr. Double Wheel-Hoe, Wheel-Plow and Cultivator, made by the same Company, will be found better. This machine is illustrated in Figure 32. It will not do to delay cultivation until the weeds get well started. Such a course will involve an immense

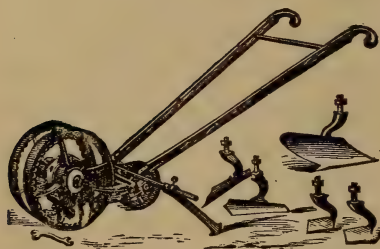


FIG. 31.—PLANET JR. COMBINED DRILL
AND HOE.

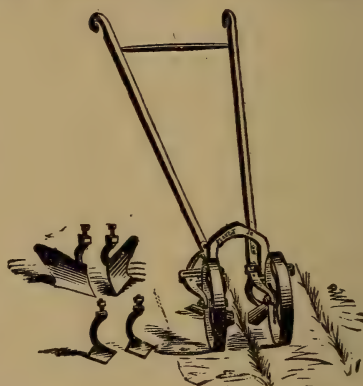


FIG. 32.—PLANET JR. WHEEL-HOE.

amount of needless labor. We have sometimes raked the rows lengthwise with an iron tooth-rake, and in this way destroyed many of the feeble weeds without injuring the onions. As soon as they are large enough the onions must be weeded. Whoever does this work must get upon his hands and knees and expect to have a tiresome job. The work should not be slighted. One good weeding is worth two imperfect ones. During the season this process will need repeating two or three times. No weeds should be allowed to grow at any time upon land devoted to this crop.

When the crop is nearly ripe, the tops of the onions will begin to fall upon the ground. For a little while after this the

bulbs will grow very fast. Then they will ripen, and the tops will die. Sometimes a crop matures unevenly. Some of the tops fall over, while many remain upright. When this occurs it is best to roll an empty flour-barrel over the rows in order to bend down the tops, and thus hasten the ripening process on the part of those plants which would otherwise remain green too long. When most of the tops are dry where they join the bulbs, the onions should be pulled. If allowed to remain longer, they may begin to grow again and very soon be spoiled.

The onions may be pulled by hand, or, if very ripe, raked out with a common hand-hay-rake. They may be put in windrows, five or six rows in each, and allowed to dry. If the tops are green they should not be stirred for several days, but if quite ripe they may be raked over, carefully, with a hay-rake, every fair day. In a short time the tops will die down and the bulbs will feel hard and be quite solid. When this stage is reached the crop is well cured. Unless they are to be sold at once, care must be taken that the tops become dry *close to the bulbs*. The end of the tops almost to the onion will often seem quite dry when the necks are green. It will not do to cut the tops in this state, as the onions will "bleed" and very soon decay. The drying must go on until the top is dead throughout its entire length. When this stage is reached, the tops may be cut, close to the bulbs, with a sharp knife, or, what we like much better, a pair of old sheep-shears. The onions can then be carried to market or stored for winter. The small ones should be separated from the large ones. They are good to eat, but on account of the extra work of fitting them for the table they will sell for only half or two-thirds as much as the large ones. The very small ones—those not larger than a hazel-nut—will sometimes sell at full rates to parties who want them for pickling.

We have made it an invariable rule to push off this crop as soon as possible after it is ripe. Other growers, who are differently situated, often find it for their interest to hold on until

the middle of October, and some keep their crops until the next spring. The latter course is sometimes the best. We have known onions to bring extremely high rates in the spring. But there is a great risk in keeping them. They sometimes decay, and when they do not they are often plenty and prices are very low. We have known growers to almost give away large quantities of onions late in the spring. No one would pay much for them, they were beginning to sprout, and many showed unmistakable signs of decay.

If it is thought best to put the crop into winter quarters, the onions should be spread, in an exposed building, about a foot and a half deep, upon the floor. A space of two feet should be left all around the pile between the onions and the boards. When the onions are frozen hard, the pile should be covered with sheets, or cloth of some kind, in order to keep the bulbs clean, and then hay should be packed between the pile and the sides of the building. The top of the pile should also be covered to a depth of two or three feet. A lattice-work bin a little inside of the outer wall would be a still better place for storage. In the bin the onions should be covered, as before directed, and hay must be placed around the outside of the slats in order to fill the space between the bin and the wall. In some sections the large growers have fitted up buildings for the special purpose of keeping this crop frozen through the winter. After the onions are frozen they should be let alone until they thaw in the spring. Then they should be spread and dried as rapidly as possible and sent to market without delay. If it is only desired to store a few onions for winter use, they may be put in barrels which have had several pieces chipped out of their sides with a hatchet, and allowed to stand in a cool room until nearly time for heavy frosts. Then they should be removed to a cool and well-ventilated cellar. The tops of the barrels should be covered to keep out the light.

As soon as the crop is got off, the bed should be cleared of

all weeds, decayed onions, and tops, and harrowed thoroughly. If any weed seeds have ripened, this working of the soil will cause them to germinate at once. In a few weeks the land should receive another harrowing. This will destroy the weeds, and these two harrowings will save an immense amount of work the next year. Late in the autumn it is a good plan to plow the ground in order that the frost may make it fine and mellow. It may need plowing again in the spring, but the fall plowing will prove highly advantageous. If the land is quite mellow, the spring preparation may be made with a cultivator. If this is designed, a liberal quantity of manure should be applied before the fall plowing is performed. In this case, we might say in any case, ashes should be used in the spring with an unsparing hand. In plowing land for onions the cultivation should always be shallow. *Never* plow deeper than five inches, and, on many soils, four is still better. If the land is light, always roll it in the spring after plowing and before it is harrowed.

In all the operations with this crop a great deal of *care* is needed. If the bulbs are cut, with a hoe or knife, they are spoiled. Careless handling when the crop is grown is very wasteful, as it will cause many of the onions to decay. All diseased bulbs should be removed from the land as soon as the trouble is discovered. If the maggot appears, a little guano may be sprinkled along the rows, or unleached ashes may be applied in the same manner. Some years this pest proves very destructive, while other seasons it does but little harm.

We usually buy our seed of the man whom we consider the best grower in the country. Occasionally we grow a small quantity. There is no trouble in obtaining seed enough. Any one can do this. But it is not every one who can grow first-class onion seed. To do this, a careful selection of bulbs, of the exact form which it is desired to produce, must be made, and they must be set very early in the season in good land and carefully tended. During the various hoeings, the earth should be

heaped around the stalks to a height of eight or ten inches, or else a framework of slats, or some stakes and strings, should be put up to support the heavy seed tops and keep the stalks from breaking over. When the seed-stalks turn yellow near the ground and the seed-cells begin to crack open, the tops, with about six inches of the stalks, should be cut, spread in a warm chamber to a depth of only a few inches, and frequently stirred. When thoroughly dry the seed may be shelled and stored in a dry place. The cleaning may be done with a fine sieve, and the imperfect seeds may be removed by putting the whole into water and skimming off all those which come to the top. The seed should be stirred while in the water, and, though a few of them might grow, it will be best to throw away all seeds which do not sink. After this is done the seed must be thoroughly dried. This is very important, as a great deal of seed is spoiled by being put away too damp. The drying may be done in a warm room, but *not* very near a fire. Some growers prefer, what is certainly a safer (and they claim almost as effective) way, to winnow their onion seed in the wind. This will take out most of the defective seeds, and there will be no danger from an excess of moisture.

There are several varieties of the onion which are grown from the black seed. The Early Red Globe is a very good and productive early onion, and the Early Cracker is a fine, light colored, but not a remarkably prolific sort. Of the late kinds the Large Red Wethersfield is very large and productive. It is a flat variety, requires a long season, looks nicely, and is a favorite in the NEW YORK market. The Early Round Danvers Yellow is an early globular bulb, ripens in a short season, is very handsome, and extremely prolific. It is the favorite in BOSTON, and dealers say that in point of quality, appearance and yield, it easily stands at the head of all the kinds grown at the NORTH. There are several other sorts, some of them great favorites in certain localities, which are not well adapted to general cultiva-

tion. A few EUROPEAN varieties are grown by market gardeners, but they are not to be recommended for cultivation on the farm.

THE PEANUT.—This is a SOUTHERN plant, and needs a warm climate in which to grow to the best advantage. But by means of skilful culture it can be grown much farther NORTH than was once supposed, and it will succeed well in the SOUTHWESTERN States. Though formerly grown largely at the SOUTH for feeding to hogs, and even now (as mentioned under the head of PEAS) used to some extent for this purpose, the peanut has become an article of great market value. Almost wholly unknown at the NORTH twenty years ago, it is now for sale in nearly every village, and town, and city, in the land. Where the climate is favorable, the cultivation of this crop is not difficult. A soil that is rich and reasonably dry should be chosen, and if the crop is designed for the market, a light-colored soil will prove the best. This because a dark soil colors the pods, and, though they are just as good for all practical purposes, the dark pods will not sell as readily as the light-colored ones. Lime seems to be a specific manure for this plant, though it should not be used alone, but in connection with a good quality of compost. The plowing should be done early in the spring and should be only four or five inches deep. The surface must be made very mellow by means of a harrow or cultivator. Then rows may be marked out, three feet apart, by plowing a light furrow. Into this trench the manure should be thrown and a furrow turned over it upon each side. This will cover the manure and make a ridge upon which the peas should be planted, two in a hill, in hills three feet apart. The planting should not be done until the ground is quite warm. The soil should be kept mellow and free from weeds, but after the vines begin to spread they must not be disturbed. The earth may be carefully drawn up to the hills, but care must be taken not to cover the vines at any time. If there are vacant places in the rows, they

may be filled by transplanting from a row in which an extra quantity of seed was planted, in order to supply such a demand. When the vines have been killed by frost, the harvesting may be done. The earth can be loosened with a fork, and the vines, with most of the pods adhering to them, be pulled by hand, or the earth may be loosened by driving between the rows with a plow having a sharp knife coulter which should be run near the hills. When they are pulled, the vines must be spread upon the ground. They should remain there for several days. When fairly cured, they may be carted to the barn and spread upon any convenient loft, or the nuts may be picked off at once. When the ground has been cleared, the hogs should be turned on and allowed to gather the nuts which remain in the soil. Some growers prefer flat culture, but we consider the ridges a very great improvement upon this method.

This crop cannot be recommended for market much farther NORTH than VIRGINIA, but for home use it can be grown in almost any State in the UNION. It has been grown in MASSACHUSETTS with considerable success. When grown at the NORTH, ridge culture should always be employed and very warm locations selected. The plants may be started in a cold frame, or in boxes in the house, and put out when all danger from frost is past and the ground has become quite warm.

POTATOES.—Although it was with great difficulty that the civilized races were persuaded that the potato was good for food, and the time when large farmers raised only a bushel or two per year has not yet passed from the memory of aged people, it has gradually won its way into the popular favor and become one of the leading crops in this country and also in foreign lands. Until the appearance of the "potato rot," this was a very productive crop and was grown at very small expense. Since that time the yield has greatly decreased and the cost of production has rapidly advanced. But it is a crop for which there is always a demand in market, and which is needed in every family. Con-

sequently it finds a place on almost every farm. In that part of the country where it succeeds, the IRISH potato is generally grown. Farther SOUTH the Sweet potato is extensively cultivated. The method of growing this crop is very simple, and the amount of labor required is not excessive. As these different kinds need different treatment, we will consider them separately.

The IRISH potato will grow in a great variety of soils, but thrives best in warm and fairly dry land. If land which is naturally wet is to be planted with potatoes, it should be thoroughly drained. Quite a quantity of potatoes may be grown in a wet field, if other things are favorable, but their quality will be poor and they will present an inferior appearance. The land for this crop should be plowed in the spring. Well-rotted yard-manure, or compost, may be spread on in liberal quantities and plowed in, or the manure may be scattered directly under the seed. If a machine is used for planting, it will be best to spread the manure. When the planting is done by hand, we prefer to put at least a part of the manure in the hills. By spreading about twenty loads of good yard-manure and using about eight hundred pounds of a good chemical fertilizer in the hills, the very best results, both as regards quantity and quality, may be secured. We consider this altogether the best way in which to grow this crop, and, while it involves some expense, think it pays better than any other plan with which we are acquainted. It is a well-known fact that, on new land, potatoes yield largely and are very free from disease. Some growers have thought that this was owing to the fact that the new soil contains large quantities of potash—an element which the potato requires, and which is very likely to be deficient in land which has long been under cultivation. The chemical fertilizers which are made for this crop contain quite a proportion of potash, and they almost invariably prove highly beneficial. Wood ashes, too, contain potash, and have proved a valuable manure for the potato. If home resources are entirely relied upon, let the land be well

coated with yard-manure and a large handful of ashes be put in each hill. On many soils a mixture of plaster and ashes, in about equal quantities, proves very useful. But we much prefer to use a special "potato fertilizer" in addition to the yard-manure. We consider old land better than sod, but this crop can be grown on the latter, if desired.

Deep plowing is not necessary, but it is very important that the soil to a depth of four or five inches should be very fine and mellow. A wheel-harrow is a good implement for fitting sod for this crop. True's Potato-Planter, manufactured by Nash &

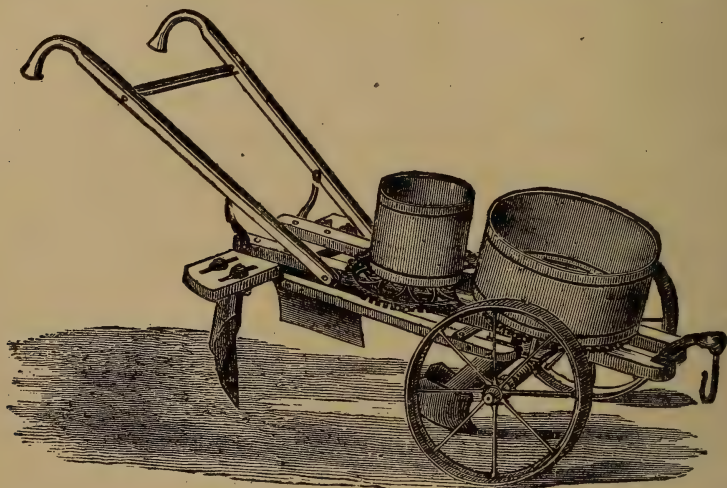


FIG. 33.—TRUE'S POTATO-PLANTER.

Bro., of New York city, is shown in Figure 33. This implement marks the rows, cuts, drops, and covers the seed at one operation. If the planting is to be done by hand, the rows should be marked with a plow which will make a small furrow, two or three inches deep. If the planting is to be in drills, no further marking is needed, but if hill culture is required, rows should be marked across the field, so that the planting can be done in squares. For the smaller kinds of potatoes the rows and hills need not be more than two and a half feet apart, but for the larger sorts three, or three and a half, feet will be better.

If planted in drills, the rows may be the same distance apart as when grown in hills, but the pieces of seed potatoes may be placed only ten or twelve inches apart. We have tried both methods and find that with equal chances the yield varies but little. On the whole we prefer growing the crop in hills. After the marking is done the fertilizer is distributed and covered. This covering may be done with a plow, and if strong manures are used, should not be neglected. Contact with concentrated fertilizers will injure if not wholly destroy the seed.

For planting, the very best potatoes should be used. Those of medium size, which are perfect in form and condition, should be selected and cut in pieces of from two to four eyes. One or two pieces should be placed, the cut side down, in each hill. We can remember when it was the custom to put one large, or two small, potatoes in each hill for seed, but we are glad to say that a more reasonable method is now in vogue. But we think there has been a tendency to go to the other extreme and not use seed enough. Cutting to single eyes and using but one or two pieces to a hill, seems too light seeding for a field crop. Too much seed is ruinous, as it will give an immense number of very small and almost worthless tubers, while too light seeding cannot possibly produce a full crop. After the seed has been dropped, it can be covered with a light plow or with hand-hoes.

As a general rule it is best to plant early in the season. When we first began to work on a farm, it was the usual practice to plant the potatoes after the corn had all been put in. Now it is the general custom to plant the potatoes first. It requires considerable time for the potato to get through the ground, and it seems to come along almost as rapidly if planted in May as it does in June. As soon as the ground is warm, and danger from frost has passed, the seed for the main crop may be safely planted. For an early crop the seed must be got in as soon as it will possibly do, and if there is danger of frost, the young

plants may be lightly covered with earth. This can be done with a one-horse plow, and will not be injurious.

As soon as the crop is well up a cultivator should be run between the rows, and also between the hills if the planting was done in squares, and the potatoes hoed by hand if necessary. It is a good plan to throw a handful of ashes and plaster, with which a little salt has been mixed, upon each hill. In ten days or a fortnight run a plow between the rows near the hills, turning the earth away from them. The furrows thus made should be four or five inches in depth, so as to leave the hills

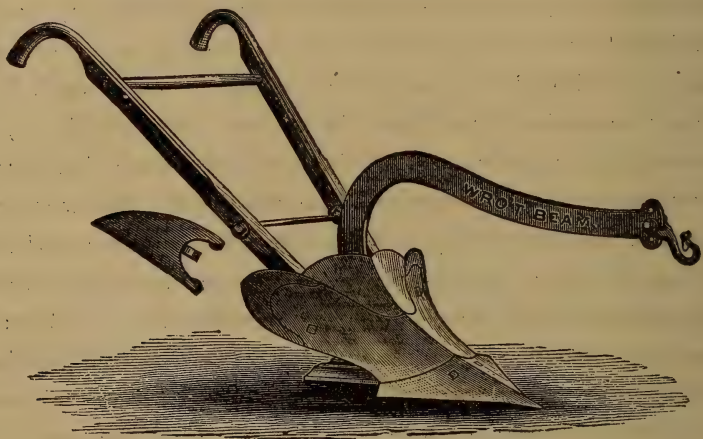


FIG. 34.—DOUBLE-MOULD BOARD-PLOW.

mere "squares of earth" upon which the sun can shine, and which the air can readily penetrate. When the vines are six or seven inches high another plowing should be given. This time a double-mould board-plow should be used, and the dirt thrown towards the hills. Figure 34 represents one of these plows made by the New York Plow Co., 55 Beekman street, New York city. Cultivation should never be given after the blossoms appear, as it will cause the setting of a new lot of tubers and thus prove very injurious.

Another method requires the use of guano alone as a fertilizer. After the land is plowed, one-half of the quantity which is to be

applied is sowed broadcast and harrowed in. Drills are then made with a large plow, and in the bottom and on the sides of the furrows thus formed one-half of the remainder of the guano is sowed. The pieces of seed-potatoes are dropped and covered two inches deep, but the drills are left open except where the seed is placed. When the shoots begin to crack the tops of the hills, the remainder of the guano is sowed along the drill and all covered over evenly with the ground. This plan was devised by MR. WILLIAM HUNT, OF CONNECTICUT, who has followed it with great success.

A few years ago the directions which have been given would have been sufficient for the cultivation of this crop, and its care until the time for harvesting. But the COLORADO BEETLE, or, as more commonly designated, the potato-bug, has made his appearance in nearly all the places in this country in which potatoes are produced, and made it necessary for the farmer to take vigorous methods for protecting the growing crop. This pest often attacks the plants when they are quite small. The female potato-bug lays some seven hundred eggs. These are usually deposited upon the under side of potato leaves. In a few days these eggs hatch into larvæ, which feed upon the plant and prove terribly destructive. If no preventive measures are taken, these pests will in a short time eat all of the leaves, and thus utterly destroy the crop. There are three broods each year, and as the eggs are laid at intervals the bugs can be found in all stages of development at almost any time during the warm weather.

Various methods have been devised for destroying this enemy of the farmer. Some potato-growers pick off and burn the leaves upon which the eggs are deposited, and gather and destroy, either by crushing, burning, or scalding, the larvæ and the full-grown bugs. This requires a great deal of time and needs frequent repetition. Consequently it proves too expensive. Another plan is for a man to take an old pail, or pan, hold it

one side of a hill and strike the vines on the other side with a short stick or an old broom. In this way most of the bugs are shaken into the vessel, and they may be easily destroyed in either of the ways noted above. A machine for gathering the bugs and which can be used with horse-power has also been invented, and when the vines have attained a sufficient size proves quite effective. But it is necessary to do something in the line of protection while the plants are very small, and this method is not applicable at that time. The only plan which has yet been devised which is at once cheap and fully reliable is to apply some poisonous substance to the vines. There are some non-poisonous mixtures sold for this purpose. Our own experience, and also our reading, inclines us to believe that these cannot be fully trusted. We were very reluctant to apply poison, and followed hand-picking for a long time. We also applied various substances, which were supposed to be safe for men, and which proved to be just as safe for the bugs, in hope that we could grow potatoes without resort to this dangerous expedient. But the force of circumstances was altogether too strong and we finally commenced using the poison. It is to be hoped, and expected, that some non-poisonous compound will be made which will be efficient. Just as soon as such an article is introduced it should be used in preference to poison. At the present writing, so far as we have been able to learn, Paris green is the best thing for the purpose which has yet been discovered. Although it is a deadly poison it can be used with safety to the farmer, and with a certainty of destroying the bugs without injuring the plants. It has been in use many years at the WEST, and is recommended by the leading growers of the potato crop, and by the highest scientific authorities.

There are several grades of this poison. The pure article is more expensive by the pound, but it is a great deal more efficient than the cheaper kinds. It may be applied in the form of a powder, or may be mixed with water. When used dry, it

should be carefully and thoroughly mixed with thirty times its weight of flour. Great care must be exercised in this mixing, as the poison is a very dusty material, and it is extremely dangerous to breathe the dust which will be almost sure to arise when the mixing is performed. If a low grade of Paris green is used, a less quantity of flour must be added to it. From fifteen to twenty times the weight of the low qualities of the poison will be sufficient. This material is to be sprinkled upon the vines when they are wet with dew or rain. The flour will cause the poison to adhere to the leaves, and in the course of their depredations the insects will take it into their systems and be destroyed. Quite a number of "dusters" with which this poison can be safely applied are now in the market. Some farmers fasten a tin box, in the bottom of which they have made several small holes, to the end of a long stick, and use it for dusting the vines. It is not well to apply the poison in this way when the wind blows, as the operator will then be liable to inhale the dust.

Another and we think a safer way is to dilute the poison with water. A tablespoonful of the poison to a gallon and a half of water will be sufficient when the green is pure. When the plants are small, only a little of this mixture should be applied, and an excessive quantity should never be used. This form of the poison can be applied by means of a common watering-pot with a sprinkler attachment. The poison will tend to settle at the bottom. Consequently the mixture must be frequently stirred. Several sprinklers have been invented which are much easier to manage, and which use the material more economically. The poison will remain on the vines for some time, unless washed off by rains. Only a few applications will be needed during the season. When the plants are small, it is a good plan to gather the bugs by hand. As soon as the eggs begin to hatch in large numbers, poison may be applied. The war with this enemy should be kept up until the close of the season. Some growers

have kept off the bugs until the tubers were nearly grown, and then let them take their course. But the destruction of the leaves at this stage is a serious injury, and will certainly prevent the ripening of the crop.

Paris green should always be handled with the greatest care. No dish in which it is placed should ever be used for any other purpose ; no package of the poison should be left within reach of children or domestic animals, and care should be taken not to scatter any of the mixture for use on the potatoes, on grass or vegetables. As soon as the crop is dug in the fall, the land should be plowed, and the potato vines turned into the bottoms of the furrows.

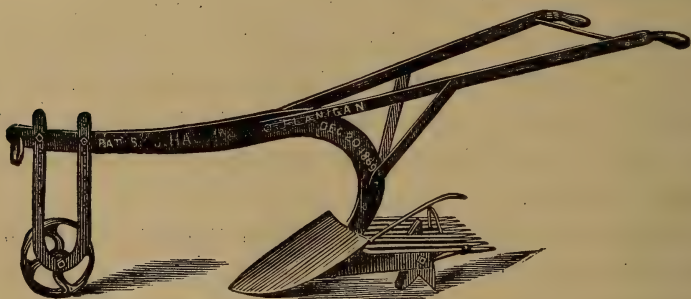


FIG. 35.—POTATO-DIGGER.

Harvesting the potato crop by hand is quite hard and slow work. The tubers may be dug with a hoe, a potato-hook, or a six-tined fork. The work can be done much faster with the fork than with the other implements. Some farmers run a plow close to the hills. This turns out many of the tubers, but as it covers some and injures others, the method is not very generally followed. A good machine for digging potatoes is almost a necessity where this crop is largely grown. In Figure 35 we present an illustration of an excellent implement for this purpose. It is made by A. Speer & Sons, Pittsburgh, Pa.

Potatoes should be dug soon after they are ripe. If allowed to remain a long time in the ground after they are matured, the

quality will be injured, and many of the tubers will decay. Besides, as the days become short and cold, the difficulty of harvesting the crop will be increased.

It is very desirable that the ground should be dry when the digging is performed. The potatoes should be picked up and put in heaps in which they can go through the sweat. The practice, which is common in some sections, of leaving the tubers exposed for a few hours to the light, and to the burning rays of the sun, is very injurious to the quality of the potatoes. The heaps in which they are placed to sweat should be kept constantly covered with straw. When the sweat is over, the potatoes may be carried to the cellar and piled on the ground, if it is perfectly dry, or in bins if the ground is wet. They should be covered with earth or a light cloth. During all the operations of harvesting, great care should be taken not to bruise or injure the tubers.

If large quantities are to be kept over, they may be buried in the ground. For this purpose a dry side hill should be chosen, and several pits holding from ten to twenty bushels each should be excavated. Or a long, shallow trench may be dug. This should be cut up and down the hill so that there shall be no trouble about drainage. As it is not well to have too many potatoes together, it is best to put in fifteen or twenty bushels at the lower end, filling the trench as full as is desirable, then at the end of the pile thus formed put in a few bundles of straw and a little dirt, then more potatoes with straw and dirt as before. The trench will thus be filled in sections. This will insure the better keeping of the tubers, and also make it safe to open the trench in winter if only a few bushels are wanted. A few furrows may be plowed at each side of the trench. They will carry off the surplus water, and furnish the dirt used to cover the potatoes. There is some risk in covering potatoes in the soil, for if covered too closely they will decay, while if not covered enough they will be spoiled by freezing. MR. COMPTON,

of PENNSYLVANIA, one of the most successful growers of this crop, recommends covering the potatoes in the pits with clean straw to the depth of six inches, and upon this throwing five or six inches of earth, except over a small space which should furnish an opening at the top which will be needed in order to give sufficient ventilation. Upon this opening a flat stone or a board, elevated at one side, should be laid in order to take off the rain which falls upon it. When the weather becomes cold a wisp of straw should be placed in this opening, and the pit covered with more earth or with coarse manure.

On a large farm it would pay to have a pit constructed, near the house, which should be walled like a cellar, covered at the top with planks and earth, with a large door at one side. In this room vegetables and fruit could be stored. They would keep much better here than in pits in the field, while the danger of storing large quantities of these articles under the house would be wholly avoided.

The varieties of the potato are almost numberless, and those which are in popular favor are constantly changing. The kinds which stood at the head of the list twenty years ago have been almost entirely superseded. Those which are now popular will probably soon go by and new ones will take their places. We are confident that, with proper care in the selection of seed, varieties *can* be kept up to their original standard of excellence for an indefinite time. Still, as many of the new sorts are said to be great improvements upon the old, there is not the motive for retaining the old kinds which there otherwise would be. The late REV. C. E. GOODRICH, of UTICA, N. Y., spent fifteen years in developing and perfecting new varieties of the potato, and to him the people of this country owe an immense debt of gratitude. Other cultivators have taken up the work and accomplished a great deal. To them, also, great praise is due. From the Garnet Chili, one of MR. GOODRICH's seedlings, MR. ALBERT BRESEE, of VERMONT, grew the Early Rose, which for many

years has stood at the very highest place among the varieties of the potato. Although it seems to be now rather going by, it has been one of the most popular potatoes ever grown, and it well deserved its popularity. MR. PRINGLE, whose new varieties of wheat are very popular at the NORTH, has also originated many new, and some valuable, varieties of the potato. The Alpha, which is probably the earliest potato in the world, is one of his seedlings. A large number of other growers have introduced valuable varieties and done much for the benefit of all who grow this crop.

SWEET POTATOES.—Until quite recently the cultivation of this crop has been confined to the SOUTHERN and MIDDLE STATES, but within a few years it has been grown at the NORTH with a very fair degree of success. This crop has proved quite reliable in MASSACHUSETTS. NORTHERN growers are obliged to take better care of it than SOUTHERN growers, but they can secure a fair crop every year. The following method of growing can be followed with success in almost any part of the country. At the SOUTH the precautions against frost will not be required. Otherwise, the cultivation may be the same.

Unlike the Irish potato, the sweet potato is grown from sprouts, or plants. These may be bought of dealers or be grown at home. In order to grow them a hot-bed, or a cold-frame, will be required. Consequently, if but few plants are wanted it is better for the farmer to buy them than to attempt to grow them. If they are to be grown in a cold-frame the soil should be covered to a depth of two inches with sand, the seed potatoes cut lengthwise and placed, cut side down, quite near each other on the sand. These pieces should be covered with from two to four inches of sand which should be kept moist and well aired. When the plants are four or five inches high they may be separated from the potatoes. This must be done with the thumb and forefinger, carefully, so as not to move the potatoes. When these sprouts are removed the same pieces will

send up another lot of plants. The bed should be started from the first to the last of April, according to the locality. In favorable seasons plants can be grown in a frame which is left open days and covered with boards at night, but it is much safer and better to have sashes with which to cover the bed. It is a good plan for those who want to grow plants to save some of the ripest and finest specimens for seed. They should be dug in a fine day, dried a few hours in the sun, then spread in a warm loft for several days, after which they should be very carefully packed in boxes or barrels, with dry sand, and put in a warm, dry place for the winter. Only perfect specimens should be saved for seed, as the slightest bruise or defect will cause them to decay. It is utterly useless to attempt to save seed potatoes by merely putting them in a bin in the cellar. Even with all the care which we have indicated, potatoes grown at the NORTH cannot always be kept sound until spring.

Sweet potatoes can be grown upon quite a variety of soils, but one which is dry, warm, and sandy will give much the finest quality. The land should be plowed to a depth of six or seven inches about the first of May, harrowed thoroughly, and marked out with a large plow in rows four feet apart. In the furrows thus made, a liberal quantity of well-rotted stable-manure should be scattered. This is to be covered by plowing a furrow each side toward the row and turning the dirt upon the manure. Then with a hand-hoe the ridges thus made should be smoothed and their tops spatted down. These ridges should be at least a foot high.

It is not well to set the plants at the NORTH until the last week in May or the first week in June, but the ridges should be made two or three weeks earlier in order that they may have time to settle before the plants are put out. When the ground is quite warm, and there is no danger of frosts, the plants may be set, upon the tops of the ridges, from fifteen to eighteen inches apart. If good plants are obtained and are carefully set

almost every one will grow. During the summer the land must be kept free from weeds, but the ridges must not be hoed down. If any weeds appear near the plants they should be pulled. Cutting with a hoe will be likely to destroy the earliest and finest tubers. These start very near the surface and are easily injured. Between the rows a common cultivator may be used to keep the land open and destroy weeds. When the vines attain a length of two or three feet they will root down at many of the joints. At the NORTH these *must* be pulled up or the crop will be ruined. Wherever these roots start a large number of potatoes will set. They will not come to any size themselves and will take nearly all the productive power from the hills. The vines may be loosened with the hands or with a wide fork. This work should be done several times during the growing season.

When the potatoes are sufficiently matured, or after the leaves have been killed by frosts, the crop should be harvested. If allowed to remain in the ground during cold, wet weather, the quality of the tubers will be seriously impaired. If possible, a dry time should be chosen in which to harvest them. The vines may be cut with a sharp corn-knife near the hills, and thrown to one side of the piece. A plow may then be run each side of the ridge, but not near enough to interfere with the tubers. This will lighten the labor of digging, but it is not absolutely necessary that it should be done. The best implement which we have found for throwing out the potatoes is a six-tined fork. They can be dug with a hoe or a pointed shovel. Care should be taken not to bruise or cut the tubers, as the slightest injury will cause speedy decay.

After lying in the sun a short time, the potatoes should be spread in a warm room to dry. After remaining here a week or two, they may be packed in sand as directed for seed-potatoes. The tubers are very easily chilled, and when chilled are utterly spoiled. It is rather difficult to keep those grown at the NORTH

later than the first of December, but there is no reason why for three months previous to that time almost every farmer should not have an abundance for family use. We have set plants in MASSACHUSETTS the first day of June, and had our first potatoes the seventh day of September. If we had grown an early variety, we could have had them at least ten days sooner.

There are but few varieties of the sweet potato. Of these the Nansemond is the most extensively grown. The Early Peabody is a better kind for NORTHERN growers. It is large, productive, and of good quality. We once obtained a good crop from plants set the twenty-fifth of June.

The great essentials to success in growing this crop at the NORTH are liberal manuring, ridge culture, and frequent loosening of the vines.

SUGAR.—As the cane, the roots and the trees, from which sugar is obtained, all are, or may profitably be, planted, it is proper that this important product should receive attention in this connection. While sugar may be made from a large number of very different substances, the principal sources of supply are the sugar-cane, the sorgo-plant, the beet-root, and the maple tree. These we will consider in the order in which they are named.

The genuine tropical plant known as the RIBBON-CANE (*Saccharum officinarum*) is the best of all the sources from which sugar is secured. It is a perennial, but is easily killed by frost and does not thrive in cool climates. The Northern limit of profitable production is said to be the thirty-second degree of latitude. Even here the plant dies down each year if not cut before frost. It does not flower as far NORTH as LOUISIANA, and the seed does not ripen well in the WEST INDIES. Propagation is carried on by cuttings, and by importations of seed from OTAHEITE. The cuttings are taken from the main stalks, planted in trenches either in the spring or fall, and send up shoots which in from eight to fourteen months are large enough

to be cut for the sugar which they contain. There are several varieties of the ribbon-cane. All of them "ratoon," or send up a growth from the roots when the stalks are cut. In LOUISIANA the plantations need renewing every two or three years, but in the WEST INDIES they last from five to ten years. It is very important that the propagation should be from first-class qualities of cane. Neglect of this very simple and reasonable

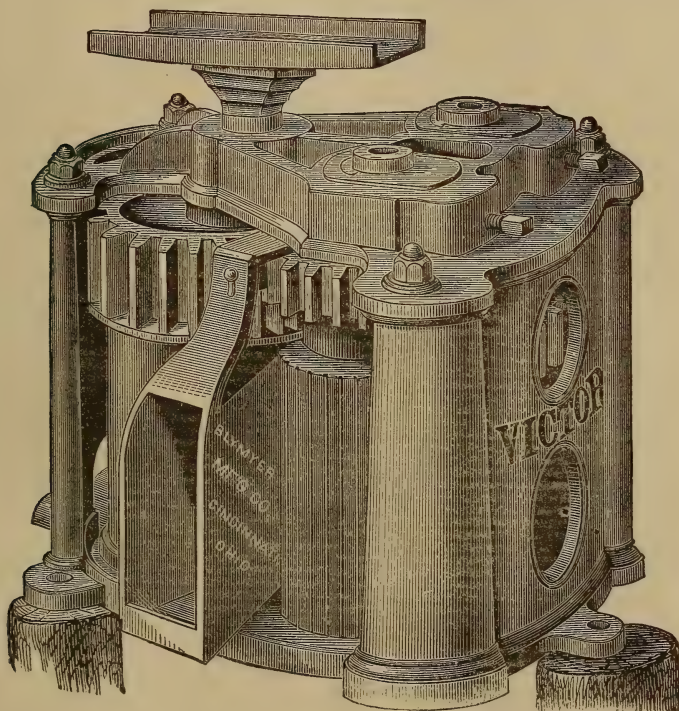


FIG. 36.—VICTOR CANE MILL.

requirement has entailed an immense loss upon the sugar-planters both in this country and the WEST INDIES. Much of the cane has also been deteriorated by want of proper cultivation and sufficient manure. The growers have not been in a condition to reach the best results with this crop. But there are indications that a better system will soon be adopted.

The land should be well drained, and deeply plowed. Cut-



FIG. 37.

tings from the sweetest and best cane should be secured and set in rows from six to eight feet apart. For this plant chemical manures are the best. They should be liberally applied to the surface of the land, and worked in with a harrow or cultivator. If yard-manure is used, it can be spread in large quantities and plowed in. The stalks should stand quite near each other in the row, and should receive frequent cultivation in order to promote their growth and keep down the weeds. The last hoeing of the season should be given early in June. At this time, the cane may be hilled up about four inches and then left until it is ripe. When the cane is ripe, which will be clearly indicated by its appearance, the tops must be cut as far down as the leaves are dry, the leaves pulled off, and the stalks cut close to the ground and carted to the mill. If it cannot be ground at once, the cane may be cut close to the ground, three rows placed in a single line, or windrow, the tops of one hill being thrown over the butts of the preceding one, and thus piled up to a height of three or four feet. When this plan is pursued, the tops should not be cut until the stalks can be ground. In this way the cane may be kept three or four weeks, and will not be injured by an ordinary frost.

In order to express all of the juice very powerful machinery is required. A lack of suitable mills has been one of the great drawbacks to profitable sugar production. Careful men estimate that forty per cent. of the sugar which was contained in the cane which has been grown during the past few years has been wasted for want of strong mills for crushing the stalks. Some very perfect mills are now in the market. They are, necessarily, quite expensive, but will in a short time enable the owner to obtain enough more sugar to pay the difference between their price and that of poor ones.

Figure 36 represents the Victor Cane Mill, made by the Blymyer Manufacturing Co., of Cincinnati, Ohio. This is designed to be driven by animal power, and is an efficient mill

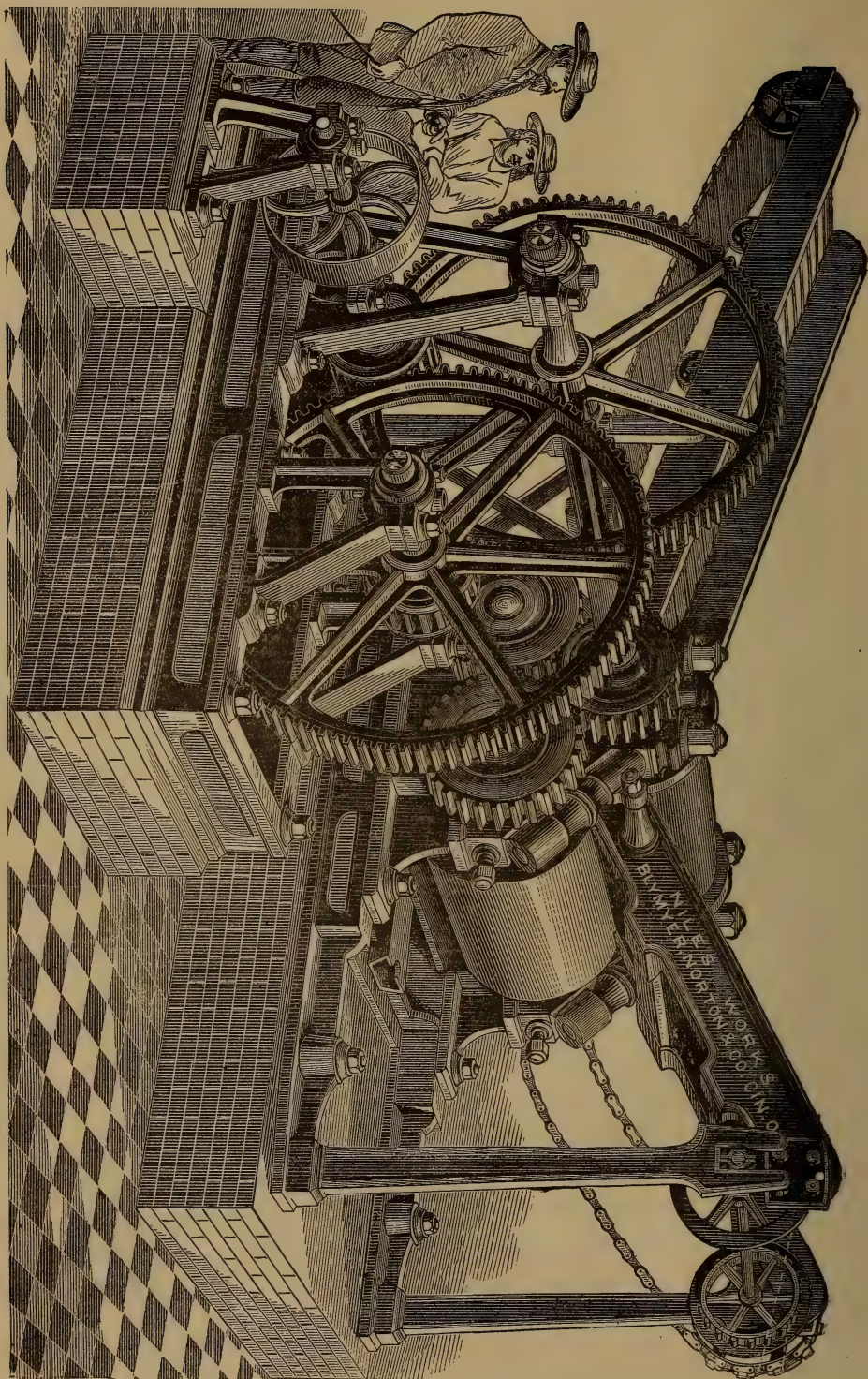


FIG. 38.—PLANTATION CANE-MILL.

for grinding either the Sorgo or the Ribbon cane. Figure 37 shows a first-class Evaporator made by the same company. Figure 38 represents their powerful Double-Geared Plantation Cane Mill.

We strongly favor the purchase of a set of first-class machinery by a company of small planters. This neighborhood system has been recommended by able writers at the SOUTH, and we are confident that it will give good results. It would easily enable the farmer to grow the cane in connection with other crops—a much better method than the production of this alone. During quite a proportion of the year labor to any great extent is not required in the sugar grounds. The hands might then be at work on the cotton crop. If four-fifths of the cultivated area is devoted to the cotton crop and the remaining fifth to the sugar cane, the work can be done to good advantage, and the profits of the business will almost certainly be larger than will be the case if only one of the crops is grown.

The fact that the people of this country are now paying one hundred and seventy-five millions of dollars per year for imported sugar and molasses, which might just as well be produced at home—even in the one State of LOUISIANA—ought to induce farmers who are now engaged in producing these articles to give a greater degree of attention to this department of their labor. Many other farmers who are suitably located might also find it for their interest to grow the sugar cane, and thus do something toward supplying the home market with articles produced on our own soil. There is always a ready market for sugar, and the intelligent producer may be very sure of obtaining fairly remunerative prices.

The SORGO (also called the CHINESE sugar cane, and the NORTHERN cane) can be grown in nearly all parts of the country. From small beginnings it has already become a very popular crop, and is destined to take a high rank among our national productions. In addition to the sorgo there are several varieties

of the AFRICAN cane. These are properly called Imphees, but are often confounded with the sorgo. Although resembling the genuine sorgo they are not as hardy, and therefore not as well adapted to cultivation at the NORTH. In growing sorgo it is highly important that good seed should be secured. This necessity is emphasized by the fact that the seed of this plant readily mixes with broom corn, millet, and similar plants. Every stain of mixture deteriorates the cane for the production of sugar. It has been found that seed grown in a cold climate will not produce as valuable cane as that which is produced farther SOUTH.

This crop can be produced on any good wheat or corn land. The best results are obtained upon sandy uplands which were well fertilized in the fall with yard-manure, or upon which chemical fertilizers, lime, or wood-ashes, are used in the spring. Deep plowing will be beneficial, and if the land is wet, ridge culture should be adopted. As soon as the soil is warm in the spring, the seed should be planted in rows four feet apart, with the hills from three to four feet apart in the row. The seed should be soaked in warm water for a day or two before it is planted. Twenty or thirty seeds should be put in each hill and they should be only slightly covered. When the stalks are a few inches high they may be thinned. From seven to ten should be left in each hill. The young plants are very weak and should receive careful attention. No weeds should be allowed to grow.

The cultivation is about the same as that recommended for corn, except that it should all be given early in the season. After the plants are three feet high, the cultivator should not be used at all or should be run very lightly between the rows.

At the SOUTH two cuttings can be obtained from the plants each year, but at the NORTH it requires some skill to get a single crop well ripened. With some of the early varieties there is no great difficulty in an ordinary season. KENNEY'S

EARLY AMBER cane has proved highly satisfactory in MINNESOTA, where it yields a large quantity of syrup and ripens its seed. It has also given good results in MASSACHUSETTS.

When the seed of the sorgo is in the dough state, and that of the imphees is in the milk, the time for cutting has arrived. It is the best way to grind the cane as soon as it is cut, but if this is impracticable, the tops may be cut off, removing one or two joints, and the canes then cut and stacked like corn, or stored in a well-ventilated shed or barn. The leaves had better remain upon the stalks until the grinding can be performed, though some growers remove them before the stalks are cut. If cut before frost, and cured with the leaves on, cane can be kept several weeks without injury. The tops should be dried, and the seed shelled and fed to stock. When well ripened the seed is considered worth more per bushel than oats. Sheep will eat it on the head, but for other animals it should be shelled and ground. On good land from twenty to twenty-five bushels of seed per acre can be secured.

By far the largest part of the sorgo grown in this country is converted into syrup, though sugar is also made to some extent. A good quality of both these articles can be secured from this plant. For their manufacture, good mills and evaporators are required. We think that where farmers grow this crop for their own use, several should club together, obtain all the necessary machinery, and use it in common. Or they might induce some one who had power and conveniences to buy a mill, and manufacture the syrup and sugar for a specified price.

We are strongly in favor of the cultivation of the sorgo. We are confident that it places within the reach of farmers in the Northern and Middle sections of the country the means for producing on their own farms a large proportion of the sugar and molasses which they need. We do not advise growing the sorgo on a large scale, as a commercial enterprise, but simply

in sufficient quantities for home use, and in order to prevent the necessity of paying out money at the store. This plan would not interfere with the one suggested in regard to the increase of the area devoted to the cultivation of the SOUTHERN cane. There is ample room for both these plants. The population of the country is increasing, and with it the demand for sugar will inevitably be augmented. Besides, if we should produce more than is needed at home, we could readily find a foreign market for all the surplus.

THE BEET-ROOT.—In EUROPE large quantities of sugar are annually produced from the beet-root, and an effort is now being made to induce farmers in this country to grow beets for the same purpose. Many experiments have been made which, as far as producing good sugar is concerned, have been fully successful, but in too many instances the cost of production has exceeded the value of the product. But recent improvements in the machinery and methods employed have greatly reduced the expense, and it is now thought that sugar can be produced from this source with profit to the grower and the manufacturer. The sugar-beet will thrive in all the NORTHERN STATES. It will also grow well enough at the SOUTH, but in warm climates it becomes deficient in saccharine matter. For the SOUTH, the ribbon-cane seems to be pre-eminently the sugar-producing plant. Farther NORTH the sorgo flourishes, while at the extreme NORTH the beet-root and the maple tree seem to be the best adapted for this purpose.

There are many varieties of the beet from which sugar can be made, but those which have smooth, long, and tapering roots, which do not grow above the surface, which are smooth, white, and hard, and which do not grow extremely large, are decidedly the best. The White Silesian seems to answer these purposes as well as any, in some respects is superior to others, and is quite generally preferred by manufacturers. But as the owner of the mill at which the sugar is made will probably either furnish

seed, or recommend his favorite kind, the farmer need have but little difficulty in determining what variety to produce.

Land which is free from stones, which does not contain mineral salts in large proportion, and which is neither wet nor clayey, should be chosen for this crop. Light, sandy, but rich soils are the best. A loose sub-soil is desirable, and a dark surface, if not colored by metallic elements, is to be preferred. Beets should not be grown upon sod, but on land which has had clean cultivation. In the fall a heavy covering of manure should be given and the land plowed to a depth of six or seven inches. A few weeks later another plowing, with a large plow and a heavy team, should be given. This time the depth should be from twelve to fifteen inches. This deep plowing is necessary in order that the beet may develop wholly beneath the soil. If the plowing is shallow, part of the root will grow above the surface. This is worse than useless for making sugar, as it contains no sugar in itself, but furnishes acids which will lessen the quantity which can be extracted from the remainder of the root. The part which grows above the ground is always cut off and fed to stock or else thrown away. After plowing, the land is harrowed and left until spring. As soon as the soil is dry and warm it must be plowed again. This time the depth should be about eight inches. If the furrows can go across those turned in the fall it will be better than to turn them the same way. If the land is wet it should be drained, thrown up in ridges, or else devoted to some other crop. After plowing, the surface soil must be made very fine with a harrow. Then the land must be rolled, or, what some consider preferable, the harrow must be turned over and used with the teeth the upper side.

When the land is in a suitable state, which at the NORTH is usually in the last part of April, the seed should be sown. The seeds should be rubbed over a screen so as to separate those which stick together and reduce them to a uniform size. They should then be steeped five or six hours in a mixture of sul-

phate of potash (nine ounces) and sulphate of lime (nine ounces) dissolved in four or five quarts of warm water, to which five or six gallons of cold water should be added after the materials are dissolved. Enough of this mixture should be used to cover the seeds. After they have been steeped the water should be turned off and the seeds dried by mixing them thoroughly with plaster or slaked lime and then spreading in a warm room. When dry enough so that they will not stick together the seeds may be sown. There are several hand-machines, and some drills which are drawn by horses, which will sow beet seeds well. The rows should be from fourteen to twenty inches apart, the seeds covered about two inches deep, and ten or twelve pounds of seed per acre should be used. The land should be rolled as soon as the sowing is finished.

As soon as the plants are up, if any weeds appear, as they probably will, cultivation should be commenced. For a small field, a wheel-hoe will be an excellent implement for this purpose. For large operations, a machine drawn by a horse will be required. If the ground close to the roots is hard it should be loosened with a light hoe, and the beets must be thinned to twelve or fourteen inches apart in the rows. If there are vacant places, transplanting can be successfully performed. The thinning may be done either at the first or second hoeing. If there are weeds in the rows, they must be carefully removed. Weeding must be done whenever needed—generally from three to six times—during the season, and by frequent hoeings, either by machines or by hand, the earth must be kept loose around the roots. If any roots begin to grow above the surface they may be hilled up in July. When the leaves are large enough to shade the soil no further cultivation will be required, except the pulling of any stray weeds which may appear, and the cutting of the flower-stalks of the few plants which may seem inclined to produce seed. If any plants throw up seed-stalks when small they may as well be pulled, but

when the roots are large they may be saved by removing the stalk.

The harvesting should be done before hard frosts, and, if possible, during fair weather. When ripe, the leaves wither and fall off. If the land is dry and the weather good the quality of the roots is improved by leaving them in the ground for a while, but if wet weather comes on it proves highly injurious. The roots may be dug with a pointed shovel, a strong fork, or may be turned out with a plow. If the dirt adheres, the beets must be struck together in order to get it off. The roots should be thrown into windrows and the tops cut off with a sharp spade or a knife. If the root grew beneath the surface the leaves should be cut close to the crown, but if any part of it grew above the ground that portion must be cut off with the leaves. When this is done the roots may be drawn in wagons, or carts, directly to the factory. They should be handled carefully, as wounds and bruises induce fermentation which lessens the quantity of sugar which can be obtained and also causes the roots to decay.

Beets may be preserved in pits, similar to those described for storing potatoes, or in piles on the surface of the ground. Or they may be frozen if they are kept steadily in this condition until wanted. When kept in piles a dry spot should be chosen, a shallow ditch dug around it for drainage, the beets piled to a height of five or six feet and covered with earth. The beets which form the walls of the pile should be carefully laid with the crowns outside, but the interior may be filled by throwing in the roots. If piled at all, the work should be done as soon as the beets are dug. When the crop can be disposed of at once it will usually be better for the farmer to draw his beets directly to the factory than it will to attempt to preserve them.

The SUGAR MAPLE has become an important source from which sugar is obtained. It is a beautiful tree and deserves to be more extensively planted both for its sugar, its beauty, and its

shade. It is a hardy tree and can be easily grown in nearly all parts of the country. At the SOUTH, however, it will not yield as much sugar as at the NORTH on account of the absence of a sufficient degree of frost. The sugar is made from the sap of the tree in the latter part of the winter and early in the spring. When the weather becomes warm enough for the sap to run, the trees are "tapped," usually with a bit or small auger, and wooden spouts are inserted in the holes thus made. These spouts conduct the sap into buckets which are placed upon the ground or hung upon the trees. Once or twice a day the sap is gathered in barrels and drawn upon a sled to the sugar-house, a little building fitted up for the purpose of sugar-making, or the arch kettle at the house. Some makers use an evaporator in preference to a kettle and find it much easier to manage.

The sap should be boiled over a steady fire, and as it evaporates, a fresh supply should be added. After boiling from eight to twelve hours, stirring often and filling up as required, the contents of the kettle should be converted into syrup as thick as can be conveniently strained. All the dirt and scum which rises during the boiling process should be removed with a skimmer as fast as it appears. When the syrup is thick enough, it should be strained into a clean tub and allowed to settle. When well settled, it should be turned into a clean kettle and subjected to further boiling. During this stage care must be taken to prevent boiling over. A piece of butter the size of a walnut is sometimes used as a preventive. Some makers dip in a piece of fat pork. If these methods are not tried, or prove inefficient, the fire must be kept so low that while the syrup will boil steadily, it will not run over. To determine when the boiling should cease, a little of the material is put upon some snow. If it cools in the form of wax on top of the snow, it is in good condition to be put into tubs, but if to be made into cakes, it should be boiled until it will break like ice when cooled in this manner. If no snow can be obtained, a little of the material must be

rapidly stirred in a dish. When it granulates with a moderate amount of stirring, it will do to put into tubs, and when, by holding a little on a stick and blowing through it, ribbons or feathers are formed, it will do to put into cakes. If to be made into cakes, the moulds which are used should be dampened with water, so that the sugar will readily come out.

During all the operations the greatest attention must be paid to cleanliness, and all the tubs, pails, and dishes in use must be kept perfectly sweet. Constant care is also needed in order to prevent burning or running over on the one hand, and to keep the boiling process going on as rapidly as possible on the other.

If the work of making maple sugar was required during the busy season, it would not be very profitable. But it can be done at a time when the farmer can do little or nothing else, and as but little expense except the labor is involved, he converts his time into money and makes the sugar season one of the most profitable ones in the whole year. In taste and appearance maple sugar is very different from cane sugar, and though for some purposes of cooking it is inferior, for others it is very much finer. Almost every one likes it to eat, and all that is of fair quality can be readily sold.

Although the product from the different sources we have named presents a great diversity in taste and appearance, each one furnishes genuine cane sugar. It is composed of very simple substances, carbon, hydrogen, and oxygen—merely charcoal and water—but so delicately and mysteriously combined, that the art of man cannot produce anything which approaches it in value. The chemist can change cane sugar to grape sugar, which is of much less value, but he cannot convert grape sugar into cane sugar. Sugar is not a manufactured article. Man cannot make it. He can extract it from certain substances in which it is contained, but it is a strictly natural production, and the chemist is as powerless to compound it as he is to make a world. But with the aid of nature it can be obtained in unlimited quantities.

Although often regarded as a luxury, sugar is a valuable article of diet. Children crave it not only for its sweet taste, but also, as good physiologists assert, because it supplies a natural want of the system. It furnishes, in a concentrated and an easily assimilable form, the same elements as are supplied by fat meat, butter, and by the starch in potatoes and bread. It is a curious fact that the demand for sugar keeps pace with the progress of civilization and the increase of intelligence. One of the first calls of a people emerging from barbarism is for sugar. To all intelligent nations sugar has become one of the great necessities. And the beneficence of God is manifested in the manner in which the means for supplying this great want have been provided. The different plants which produce sugar in abundance are adapted to the different parts of the world, and at least one of them will grow in one or more of the thickly settled portions of the globe. Each part of the world has a sugar-producing plant which is adapted to its climate. Thus the means of supply have been made as extensive as the demand. The prosperity of the country requires a largely increased rate of sugar production, and it is to be hoped that this important industry will soon receive the attention which it deserves.

TEA.—A large number of experiments which have been made during the past twenty years, and especially those which have been quite recently carried on, seem to have proved that tea can be successfully and economically produced in the SOUTHERN half of the UNITED STATES. We do not recommend this plant for cultivation on a large scale. Probably the majority of our standard crops pay much better than tea can be made to do, if grown for the market. But we are confident that on a small scale the farmer and gardener can produce good tea at a less cost than the imported article involves. Merely for home use we think it will pay the SOUTHERN farmers to cultivate tea, and we will give a few simple directions for its growth on a small scale.

In its wild state the tea plant grows in the form of a tree. Sometimes it reaches a height of thirty feet, and its trunk measures ten inches in diameter. But in this country it grows merely as a shrub. In order to make it more productive, and to facilitate the gathering of the leaves, the plant is often pruned. The first year it should be headed in by cutting off the top of the plant. This will insure a stronger growth and cause a lateral development. The after-pruning which is needed must be in the line of removing straggling branches which may appear, and so clipping the ends of the branches as to give the shrub a conical form. After reaching an age of nine or ten years the plants are cut down, in order that the young shoots, which will soon spring up, may give a greater supply of leaves.

The tea plant will do well in quite a variety of soils. Too much water is very injurious. Excessively rich land is not required, but the soil should be in fair condition, and should be kept under cultivation. The plant is grown from seeds, similar in appearance to hazel-nuts, which come up readily when left under the bushes from which they have dropped. The plants may be started in this way, by planting the seeds in a nursery, or where the shrubs are to grow. It requires some time for the seeds to germinate, and if planted they should be put in a cool, moist, and shaded place. When from six months to one year old, the shrubs can be readily transplanted if care is taken not to break the long tap-root. The young plants are often destroyed by the heat of the sun. Consequently it is best to shade them during the first year. Probably heavy mulching would prove highly beneficial. When two or three feet high, the plants will produce flowers and seed as well as leaves. They are evergreen and quite ornamental. They will successfully resist the winter where the mercury does not go more than five or ten degrees below zero, and they are not injured by an ordinary drought in summer.

The leaves should not be taken from cultivated plants until

they are three years old. They are gathered three times each year. The yield will vary with the size of the plant and the care which it receives. Half a dozen good plants should furnish all the tea required in an ordinary family. The shrubs should stand about four feet apart each way.

The greatest difficulty with this crop is in curing it properly. The methods in use in tea-growing countries require so much time and labor that they cannot be adopted here. Some of the parties who have been growing the tea plant merely heat the leaves in an oven, and then spread in a spare-room to dry, while others follow a much more elaborate method. MRS. SCREVEN, of GEORGIA, proceeds very nearly as follows: Spread the leaves on tables as soon as they are gathered. The next day the leaves, which have become somewhat wilted, are rubbed in the hands until they become soft. They are then left in heaps for an hour or two, when they are put into a Dutch oven and roasted over a moderate fire. While in the oven, the leaves are constantly stirred to prevent burning. After roasting for five minutes they are again rubbed and rolled on the table. Then they are spread in the sun and frequently stirred. After drying a short time, they are roasted and rolled again as before. They are then placed about an inch thick upon a sieve, and held over some hot coals. During this process they must be constantly stirred. They are then taken out and rolled again. This work must be continued until the leaves assume a dark color. They are then put in a basket, hung over some coals, and stirred until the leaves are black and dry. They should then be packed in tight boxes made of tin or wood. This method involves a great deal of work, and requires considerable skill and close attention. But by its means a very fine quality of tea may be secured—much finer, it is said, than any which is brought here from abroad. The thorough working and rolling, which is recommended, seems to be absolutely necessary to the securing of a fine flavor.

Parties who grow their own tea cannot only save the money which would be needed to purchase it, but they also have the great advantage of obtaining a pure article. It is also stated that the capsules of the tea-nuts possess a bitter property which is equal to the famous, expensive, but indispensable, cinchona. This, if the claim proves to be well founded, will add greatly to the value of the plant. While we do not advise the cultivation of the tea plant on a large scale until further trial has been made, we do believe that it is for the interest of the average SOUTHERN farmer to grow a few plants, and make an effort to produce all the tea required for home consumption.

TOBACCO.—This has, we are sorry to say, become one of the leading crops in many localities, and is grown on a larger or smaller scale in nearly all sections of the country. The varieties which are most in demand are the CONNECTICUT seed-leaf, the VIRGINIA, the HAVANA, and a large number of sub-varieties caused by differences in soil, climate and cultivation. For the NORTH, the genuine CONNECTICUT seed-leaf is undoubtedly the best kind. This variety also does well in the MIDDLE STATES. At the SOUTH, the HAVANA tobacco is often preferred, though other kinds are largely grown.

This crop needs a warm and extremely rich soil, and a warm climate is desirable. The seed should be sown in a carefully prepared bed in a sheltered position, about the middle of March. This bed must be rich, and the surface soil must be made extremely fine. As the seed is very small, it is best to mix it with fine earth, or sand, before sowing. Otherwise the plants will be likely to come up very unevenly. It is a good plan to burn a pile of brush upon the bed before it is sowed. The fire will kill the weed-seeds, while the ashes will prove useful as a fertilizer. But little seed is required. One tablespoonful of nice seed will furnish plants enough for five acres of land. But as some of the seeds may not grow, and many of the plants may be destroyed, it is best to use a larger quantity than is

usually thought necessary. After sowing the seed, the bed should be rolled with a hand-roller, and covered with brush. If the surface becomes dry, it must be occasionally watered. The seed grows slowly, and the plants will not appear until about three weeks after the sowing is performed. The weeds must be carefully removed. In order to make this work easier, the bed should be made on land which is not very weedy (as many of the seeds may escape the fire when the brush is burned), manure which is free from seeds should be used, and the bed should be long and narrow. Several weedings may be required, but under favorable circumstances one or two will be effectual. This work must not be slighted, but should be attended to promptly and as often as necessary.

The tobacco plant grows very rapidly. Consequently it needs its food in a condition in which it can be readily appropriated. Any well-rotted manure will do, but the better the quality of the manure the heavier and better will be the crop. Special fertilizers for tobacco are prepared by several manufacturers. These can be profitably used in connection with yard-manure. Heavy manuring is one of the great essentials of success with this crop, and there is no danger of getting the land too rich. Green manure (made from decaying plants) often proves highly beneficial.

It is not well to grow this crop on sod land. It ought to follow a crop which was well manured and which received clean cultivation. The land should be plowed early in the spring, and receive a second plowing just before the plants are ready to be put out. Some growers only plow once. Before the last plowing a large quantity of the best manure should be spread upon the land. This should be turned in by a plow running six or seven inches deep. The surface should be made very fine with a harrow, or a roller should be used if necessary to secure this result. When level culture is pursued, the land should be marked both ways with a small plow. The rows should be

three feet apart and the marks for the hills two feet. If very large varieties are grown, the hills must be three feet apart. If the land is not very rich some tobacco fertilizer, guano, or wood-ashes, may be scattered in these drills. Where the furrows cross each other, small hills should be made with a hoe and the tops spatted down. When ridge culture is chosen, a tobacco ridger should be used to make the ridges and mark the places for the plants. This work should be done but a short time before the plants are ready to be set.

The setting may be done any time from the first to the last of June. For the latitude of NEW YORK the middle of the month will usually do very well. It is a great help to have the ground wet with showers or to have a rainy day precede the setting of the plants. But it is not best to wait too long for rain. The extra work had better be done than to have the setting come too late in the season. In taking the plants from the bed it is best to loosen the earth with a trowel, and then pick up the plants separately. They should be taken to the field in baskets, and one dropped at the side of each hill. In setting, the plant should be taken in the left hand and a hole made in the centre of the hill with a stick held in the right hand. The hole should be just deep enough to take in the root, without bending, to the same level at which it stood in the seed-bed. The earth should be packed closely around the root by pressing upon it with the forefinger and thumb. Considerable pressure should be given in order that the hole may be closed at the bottom as well as the top. It pays to do this work well. If the ground is wet, and the plants carefully put out, most of them will live. It is a good plan to shade them with leaves, or pieces of paper, for a day or two, though this is not absolutely necessary.

If the ground is very dry the labor will be greatly increased. The seed-bed must be watered before the plants are taken out, and water must be turned upon the hills before the setting is done. Shading will then be necessary. The plants should be

watered at night, and may require watering once a day for three or four days. The watering before the plants are put out should be quite liberal. A light watering at this time is no advantage. Some growers never use water until the plants are set, but it is better to put them into wet soil.

During the early stages of its growth this crop requires considerable cultivation. PROUT'S HOEING MACHINE, Figure 20, is a good implement for the purpose. A good cultivator also answers very well. Hand-hoeing will be required three or four times during the season. When the leaves are large they break easily. Cultivation must then be abandoned. But until then the ground should be kept very fine and mellow, and all weeds which appear should be eradicated. Tillage not only keeps the land clean, but proves a great benefit to the growing crop.

The principal enemies of this plant are the cut-worm, which eats off the stalk soon after the tobacco is set out, and the large green worm which comes later and feeds voraciously upon the leaves. In order to guard against the cut-worm it is necessary to keep a close watch of the field for several days after putting out the plants. By going among the plants early in the morning the worms can be found. Small heaps of fresh dirt and small round holes near the hills indicate the presence of the enemy. If part or all of the leaves of a plant are cut off, there is, in this fact, abundant evidence that a cut-worm is near. Whenever and wherever one of these worms can be found in a tobacco field, it should be destroyed. It pays, where there are many of these pests, to go around and dig them out of the hills. When a plant has been destroyed, a new one should be put in its place. But before setting a new one, diligent search should be made for the destroyer of the other. If let alone, he will continue to cut off the plants as fast as they are provided. The worm which feeds upon the leaves is hatched from an egg deposited by a moth, and at first is so small as to escape ordinary observation. But it grows very rapidly and proves terribly destructive.

It begins to eat the leaf, on the under side, when it is no larger than a small needle. A small hole through the leaf is the first sign of its operations. The leaf must be turned over and the worm removed and destroyed. If left for a few days, the worm will rapidly increase in size and will utterly spoil the leaf. When full-grown one of these worms is as long and almost as large as a man's finger, and will eat nearly the whole of a large leaf in a day. There are two sets of these worms each season. The first lot appear when the plants are nearly half grown, and the others when the tobacco is almost ripe. During the season for these pests the plants must be looked over almost every day, and all the worms and eggs which can be found must be destroyed. The worms are quite formidable-looking creatures, but are perfectly harmless to man and beast. They are usually crushed between the thumb and fore-finger of the man who finds them.

In order to increase the size and value of the lower leaves, prevent the plant from seeding, and hasten its maturity, the tobacco needs to be topped. This should be done as soon as the blossom-bud on top of the stalk is formed. It consists in breaking off the top of the stalk. The length to be removed will depend upon the condition of the plant, but it is a safe rule to take off all the leaves which are less than six inches in length. If it is very late in the season, it may be necessary to break the top still lower and take off a few larger leaves.

After the topping is done, suckers will begin to grow from the stalk at the upper side of each leaf. As soon as the top suckers are three or four inches long, the field should be gone over and all on the upper half of the stalks should be broken off. Those near the ground are then so small that they can be safely left until the next suckering. In a week or ten days the plants will be ready to cut. All the suckers should be broken off and all the worms removed just before the tobacco is ripe.

It is somewhat difficult for a beginner to tell when to-

bacco is just ripe enough to cut. When the plant is mature the leaves assume a spotted appearance, seem to be considerably thicker than they were a few days before, and if doubled and pressed, the leaf will break off short. Some growers judge entirely by the color. Others insist that the plant should stand until the leaves can be folded *without* breaking. While it is very desirable that the plant should fully mature, it very rapidly deteriorates by getting over-ripe. It is also necessary that the harvesting should be done before cold weather, as even a slight frost proves ruinous to every leaf which is touched. Better cut before it is ripe than run much risk of having the plants frosted. A tobacco hatchet is the best implement with which to cut this crop. If this is not at hand, a sharp butcher-knife, or a corn-cutter, may be used. Some growers in this section use a common hand-saw. The plant should be bent over with the left hand, and a quick stroke of the hatchet, or a drawing cut with the knife, should be given. The plant must be cut close to the ground, and left for a while to wilt. The tobacco should not be cut when wet with dew or rain, or in the middle of a very hot day, and must not lie long enough in the field to be sunburned. As soon as it is sufficiently wilted so that it will not break easily when handled, it should be drawn to the shed or barn and hung up to cure. Some growers merely load tobacco on a wagon as they do corn, handling carefully so as not to tear the leaves, and take it to the barn to put upon sticks, while others get it on the sticks in the field. The latter way is much the best.

The plants should be hung upon lath. They are put on by means of a large steel needle, with a socket at one end, which fits on the end of the stick. The lath is laid upon a convenient "horse," or one end is placed on a block lying on the ground, and the needle slipped on. The plant is then taken in both hands and forced upon the lath. From six to ten plants may be put upon a common lath. When one stick is filled, it is laid aside

and plants are strung upon another. These sticks are carted to the barn on a wagon with side boards arranged for the purpose, and there laid upon rails or cross-beams previously arranged for their reception. This method is a vast improvement over the old way of tying each plant to a rail with twine and the somewhat newer plan, which many growers still follow, of driving a peg into each stalk and hanging it upon a pole.

If only a little tobacco is grown, it can be hung in a shed or over the barn floor. But when grown on a large scale, a tobacco barn will be required. The interior of this building is composed of beams and joists, in several tiers, arranged to receive the lath or poles, to which the plants are secured. Of the outside covering from one-third to one-half of the boards should be hung on hinges, so that they can be opened for the admission of the light and air. The laths upon which tobacco has been hung should not be placed nearer together than eight inches in a well-ventilated building. If hung in a common barn, considerable more room must be given. After the plants are hung, the doors should be kept open during fine weather until they are cured. In rainy weather the building should be closed, and when the curing is completed the doors should remain closed all of the time.

When warm, wet weather comes on late in the fall, or in the winter, the tobacco should be taken down and stripped. In order to keep them moist the plants are taken from the sticks, and put in small piles on the floor. The leaves are pulled from the stalks, and tied up with one of the leaves, in little bundles of three or four ounces each. One leaf should be taken off at a time, and each one should be kept straight. The leaves should be assorted according to their quality. The bunches of bottom leaves, and all which are torn, worm-eaten, or otherwise injured, should be kept by themselves. The bright and nice leaves should be bunched together, and those which present a dull, dead color should also be kept separate. As the manner

of sorting differs considerably in different sections, it will pay the beginner to take a few lessons of some experienced grower in his vicinity. The bunches of leaves should be laid in piles on the floor. The butts must be put outside, and the tips should lap about one-third of their length. The pile should be neatly laid and pressed down by treading, or by laying on heavy weights. It must be kept covered with blankets in order to prevent undue drying. In this condition it can be sold to buyers who will put it in cases, or it may be cased by the grower.

The boxes can be made by the farmer, but it is much better for him to buy them of the manufacturers. The ordinary boxes are three feet and a half long, two feet and a half wide, and two feet and a half deep. The tobacco should be packed by a man in the box, who should crowd it down with his knees. When full, the tobacco should be placed under a press, or crowded down by means of a long lever which presses upon a block, laid on a follower which will just go inside of the box. More tobacco can then be put in. It may be laid about six inches higher than the edges of the box, and pressed down even with them. The top should then be firmly nailed. A box of this size, filled in the way described, will hold about three hundred pounds. In the SOUTH, and some parts of the WEST, hogsheads which will hold, when pressed, from fifteen to eighteen hundred pounds of tobacco are used for this purpose.

Growers who raise their own seed usually leave from one to half a dozen of the best plants without topping. Four plants ought to yield half a pint of seed—enough to stock several acres. From the seed-plants the worms should be kept off the whole season. The suckers should also be removed, and at cutting time most of the leaves should be taken off. When the pods have turned black, the heads should be cut off and hung in a dry place to cure. When thoroughly dry, the seed may be shelled, cleaned in a fine sieve, put into a box, and laid away until it is needed for use.

The tobacco crop needs constant care, and is liable to various injuries. Many fine crops which were almost ready to harvest have been utterly spoiled by a hail-storm of a few minutes duration. From the time the plants are put out until the tobacco is sold there is a great deal of risk. Worms, or hail, or winds, may injure or destroy it, there is danger of burning while wilting in the field, and spoiling while curing in the barn, and even after it was packed it has been known to heat and spoil. Much of the work connected with the growth of the crop is dirty and disagreeable. It is also unhealthy. Tobacco is a very exhausting crop for the land. If grown often upon the same fields without heavy applications of manure, they will soon be ruined. The exhausted tobacco lands of VIRGINIA show what its constant cultivation will accomplish. In NEW ENGLAND many of the finest farms have been injured by its growth. Almost all of the manure made on the farms has been put on the small tobacco fields in order to get them rich enough to produce this crop. As a consequence a small part of the land is in good condition, while most of it has been exhausted by repeatedly cropping it without manure. The small field has been made rich at the expense of all the rest of the farm. The ordinary farmer does not have manure enough to grow tobacco in connection with other farm crops. If he attempts to do it, he must either slight and starve the other crops, or else grow poor tobacco. If he buys manure in order to carry out both the farm crops and the tobacco, he will incur a great expense, and run the risk of heavy loss. If he buys manure and makes tobacco-growing a specialty, he takes a still greater risk. His expenses for fertilizers and labor must be met from the income of the farm. If the tobacco is good, and finds a ready market, there will be no great difficulty in these respects; but if the crop is poor, or cannot be sold, the farmer will sustain a very heavy loss. On the whole, viewed merely in a business light, tobacco-growing carries too much risk for the ordinary

farmer to safely incur. We have seen many good farms impoverished, and their owners financially ruined by a train of circumstances in which tobacco-growing was the leading influence. When to the risk which the farmer is obliged to take in its production is added the moral evil, which identifies itself with the use of tobacco, we certainly have sufficient reasons why the cultivation of this crop should not be continued. There are a large number of crops which the farmer can produce with profit to himself and benefit to the world. Such crops should be largely grown, while those which are pernicious, as tobacco is (even by those who use it) almost universally acknowledged to be, should be let entirely alone.

THE YAM.—This is an esculent tuber which is extensively grown in the EAST and WEST INDIES and other tropical countries. There are several varieties, some of which are more hardy than others. Those which are grown in the warmest countries form a staple article of food for the inhabitants. A variety growing in CHINA and JAPAN has been introduced into this country. It goes by the common name of CHINESE YAM, and, at intervals, for many years efforts have been made by parties acquainted with its merits to secure its general cultivation. But it has never become a popular plant in the UNITED STATES, and we hardly think that it will ever be grown here to any great extent.

The CHINESE yam is similar in appearance, though smaller in size, to the yams produced in the INDIES, and can be used in the same manner. It is a climbing plant, sending up a slender, twining, vine with heart-shaped leaves. The vine forms a very good covering for screens. During the summer it puts out clusters of very small white flowers. It is propagated by bulblets which grow upon the vines, or by planting small roots. From the roots a crop can be obtained the first season, but when the bulblets are planted two seasons will be needed to secure roots of suitable size for cooking purposes. The land in which yams

are to be grown should be moderately rich and plowed as deeply as possible. The bulblets may be planted eight inches apart. If roots are used, more room should be given. Weeds should be kept down, and an occasional hoeing will be beneficial. The vines may be made to climb some long poles, like beans, or allowed to creep over the ground. The roots are not destroyed by frost, but will live, unprotected, through a NEW ENGLAND winter and grow vigorously the next spring. A plantation once started can be kept along with very little trouble. By digging the large roots and leaving the small ones, a supply for family use can be secured from a small plot of ground and the stock kept constantly good.

The great difficulty with this crop is to get the roots. They grow two or three feet in length and the large end is always down. Consequently, a great deal of digging is required to loosen them. They might be plowed out, with a large plow and a strong team, but this would destroy the permanence of the plantation and make it necessary to put out a new stock each spring.

Concerning the quality of these tubers there is a great difference of opinion. Some people consider them very fine, while others do not like them. The flesh is extremely white, and, when boiled, or roasted, tastes very much like rice. In the INDIES these tubers are ground into flour and made into bread and puddings, as well as used in simpler forms. There is no doubt that for those who like it the yam is a healthful and nutritious food. We have never grown it largely, and, while we recognize its merits, we have no desire to increase the area which we at first assigned to it in our garden.

The crops grown especially for FORAGE are but few in number, though of great importance to the farmer and absolutely necessary to the maintenance of his live-stock. GRASS is the leading crop in this class and is one of the most valuable of all the plants grown upon the farm. There are a large number of

different varieties, possessing different characteristics, and it is easy to find several sorts which are adapted to each of the various kinds of soil. With the exception of those which are utterly barren, grass is a natural product of all fields and will grow upon them of its own accord. While other plants must be got into the land by the agency of man, and need cultivation in order to make them profitable, grass will take possession of the soil without even an invitation and grow freely if it is let entirely alone. Consequently, it is one of the easiest of all crops for the farmer to produce. By means of a careful selection of varieties, and judicious cultivation, he can improve the quality and increase the quantity of grass which will grow on a given area of land. Nature will do much to help him, and he ought, with so many favoring circumstances and so much help from natural influences, to make this crop the source of a generous profit.

The cultivation of the grass crop has long been regarded at the NORTH as the basis of all successful farming, and this idea is now being quite generally embraced by the leading farmers of the SOUTH. In the latter section, on account of the extreme heat of the summer months, it is more difficult to grow this crop in perfection than it is at the NORTH. But even at the extreme SOUTH grass, of excellent varieties, can be produced, and we are confident that its general introduction as a standard crop would very greatly increase the profits of the SOUTHERN farmer. One-quarter of the care and skill which the NORTHERN farmer gives to the corn crop, and the SOUTHERN farmer gives to his cotton, would insure a high degree of success.

One of the important conditions of the successful culture of the grass crop is a proper selection of varieties. There are thousands of kinds known to botanists, and two hundred varieties are cultivated in ENGLAND, but only about thirty sorts are recognized as valuable for extensive dissemination in this country. Of these we will mention and describe only a few of

the leading sorts, as we consider a statement of the principles of cultivation much more valuable and useful for the farmer than a catalogue of the names of all the varieties grown in the country.

TIMOTHY.—This we consider the very best grass for hay which can be produced. It flourishes throughout the NORTH and on the drained lowlands of the SOUTH. It is very productive and highly nutritious. In the SOUTHERN city markets hay made from this grass commands the very highest price, while in other sections it is always a standard. It is a perennial plant, but land which produces it usually needs reseeding in from three to six years. It does not do its best in a wet soil, or on very dry and sandy land. Still, fair crops are often grown on very moist land, and also on gravel knolls. It ripens rather late, and on this account does not yield much aftermath. As a pasture grass it is very good. At the NORTH it is often grown with clover for hay, but as the two plants do not ripen at the same time one of them must be used at a disadvantage. It makes splendid hay when grown alone, and can be profitably cultivated in this way. Red Top is sometimes grown with it. We consider this mixture a decided disadvantage as far as the hay is concerned, but it makes a more permanent crop for moist land than the Timothy alone. The Timothy should be cut when in blossom. It will increase in weight if it is allowed to ripen, and horses will eat it well in this state, but when mature it is rather too hard and woody for cows. If used alone, from twelve to twenty-four quarts of seed per acre should be sown.

RED TOP.—This is a tall, hardy, luxuriant, perennial grass, which flourishes in moist soils and grows in dry ones. Some writers consider it very valuable, while others assert that the hay is of poor quality. MR. HOWARD, in his work on FORAGE PLANTS AT THE SOUTH, ranks it next to Timothy and recommends sowing the two together. When grown by itself, from twelve to sixteen quarts of seed per acre should be used. We

like it very much for permanent pastures, especially for those which are moist, but, on account of the difficulty with which it can be subdued, we do not like to sow it in cultivated fields. This grass is known in the MIDDLE and SOUTHERN States by the name of Herds Grass—a title which in the NEW ENGLAND States is often given to Timothy.

ORCHARD GRASS.—This grass flourishes throughout the whole country. It grows readily in the shade, and endures drought remarkably well. It ripens at the same time as clover. For hay it should be cut before the seed is formed, and is better for an admixture of meadow oat-grass and clover. It springs up quickly after being cut, and yields a good crop of rowen. It is also valuable for pasture and may be quite closely fed. The seed is extremely light and chaffy. From one to two bushels are used when this grass is grown separately, but as it grows in tufts some other kind should be mixed with it in order to cover the whole of the land.

OAT GRASS.—This is a large-growing variety which starts early in the spring and is very good for either hay or pasture. It is quite permanent. The seed is light and two bushels per acre should be used. The seed ripens while the stalk is yet green, and a crop of seed can be secured in connection with a very good quality of hay. This grass grows in bunches and needs thick sowing in order to, as far as possible, counteract this tendency. It is well adapted to rich land, and will give two good crops per year. For furnishing winter pastures at the SOUTH, this is one of the very best of plants.

BLUE GRASS.—This grass flourishes on rich uplands, and, where soil and climate are favorable, gives excellent hay and permanent pastures. By some writers the June grass of NEW ENGLAND and the MIDDLE STATES is said to be the same as blue grass, but others deny its identity. If the same, it does not reach that degree of perfection in other localities which it attains in the limestone soils of KENTUCKY. It is liable to be

affected by severe drought, but otherwise endures vicissitudes of climate as well as other grasses. It should not be grown upon land which is often plowed. It starts very slowly and needs four years in which to become fully developed. The first year after seeding but little of it will appear, and that will be very small and fine. The next season there will be a little more, the third year a great deal more, while during the fourth season it will make a luxuriant growth. On account of this slow development orchard grass seed and clover, or oat grass, should be sowed with the blue grass. The other grasses will keep down the weeds and give abundant shade. The blue grass will, in time, overpower the other varieties and take full possession of the soil. Only four quarts of seed is required for an acre. Before sowing, the land should be made very rich and the surface should be finely pulverized. This grass is one of the very best for pastures and ought to be more generally used.

MEADOW FESCUE.—This is an early grass which thrives on wet land, and gives a good quality of hay as well as excellent pasturage. MR. FLINT highly recommends it.

FOWL MEADOW.—This is a valuable grass for moist soils. It is very early, but, unlike almost all other varieties, it remains good for several weeks. If grown on rich land, two crops per year can be obtained. The quality of the hay is very fine.

SWEET SCENTED VERNAL GRASS contains an immense amount of water and is not desirable for mowing-lots. It is very sweet, starts early in the spring, and makes a steady growth. On these accounts it is well liked in pastures. A little of the seed may be mixed with that of other kinds when pastures are laid down, but it will not pay to sow it too liberally, as most of the room which it would require can be used to much better advantage.

BERMUDA GRASS.—Concerning this grass there is a great difference of opinion. It was introduced from the WEST INDIES,

and has become thoroughly acclimated throughout the SOUTH. To the cotton-planter it has made an immense amount of trouble, and until quite recently it has been pretty generally condemned. But at the present time many writers, among whom is MR. HOWARD, consider it a valuable plant. It is pre-eminently a *permanent* plant. Once in the soil it resists all ordinary efforts for its eradication. Cattle like it, and will thrive when kept upon it. It is said to make a fair quality of hay. It produces a very heavy sod, which is valuable to turn in as a fertilizer for other crops. In connection with clover and blue grass, which are fresh when the Bermuda dies down, it makes an excellent pasture, which will keep fresh at the SOUTH during the whole year. Notwithstanding that many writers in the papers seem to fear its introduction, and wish that it could be utterly destroyed, we think that it will pay the farmers of the SOUTH to experiment with it, on a small scale at first, and fully test its character. It may prove one of the most useful plants which can be obtained.

In addition to the kinds which have been named there are many others which are of different degrees of value. There are marsh grasses which grow only in very wet soils, prairie grasses which grow wild at the WEST, and several native grasses which appear at the SOUTH. As a general rule the native grasses are of inferior quality, and should be superseded by the finer cultivated varieties. It never pays to grow a poor kind of grass where a much better one can easily be produced.

We will now consider some of the general principles upon which the culture of the grass crop should be conducted. The PREPARATION OF THE SOIL is a very important matter—one which lies at the very foundation of the whole system. Probably the great majority of farmers throughout the country sow nearly all of their grass seed in connection with grain. They fit their land for the grain crop, and, with the exception of covering it, do nothing more to the land than they would if the

grass seed had not been put in. That it is not as well to seed land with a crop of rye, or oats, or corn, as it would be to sow grass seed alone, no argument is required to prove. Common-sense, science and experience all go to show that it is better when grass is to be grown to give it a fair start, than it is to put with it a stronger crop to choke it and keep it down. The grass suffers a double injury. The grain crop takes possession of the land, and appropriates the elements of fertility which are within easy reach, and which the little grass plants ought to secure. Then the plants are injured by the trampling to which they are subjected when the grain is cut and carted off, and, having been shaded so long, they are badly injured by the burning rays of the sun after the grain which furnished the shade has been removed. Nearly all farmers admit that sowing grass with grain is an evil, but most who follow this method consider it a sort of necessity and can see no better way in which to proceed. If they had plenty of manure, they would follow a different course. But they want to get all they can from the land with the least possible outlay of labor, and the smallest possible quantity of manure. Therefore, the present system of seeding with grain will probably continue in common use. When it is followed, the land should be made quite fertile, and the surface should be well prepared to receive the seed.

When grass seed is used alone, it may be sowed either in the spring or late in the summer. As far as the grass is concerned, the former may be considered the best time, as it gives the plants a longer period in which to develop before they are cut and enables them to obtain a stronger hold upon life. But this requires the use of the land two seasons in order to obtain the crop which should be produced in one. Consequently, later seeding, which permits the removal of a crop the first year, is usually preferred. The best time for this work is during the month of August at the NORTH and September farther SOUTH. Sod land is often turned over for reseeding. The land should

be plowed to a medium depth, a fair coating of manure should be spread upon the plowed surface, or guano or grass fertilizer should be sowed broadcast upon it, and a wheel-harrow, or some other very efficient pulverizer, should be used until the surface soil is extremely fine. The seed may then be sowed, covered with a bush-harrow, and the land thoroughly rolled. As a general rule, to which the culture of Timothy is the prominent exception, it is much better to mix several kinds of grass seed than it is to sow any one of them alone.

The quantity of seed required will depend upon the varieties to be grown, and the purposes for which the grass is designed. Light seeding makes large, coarse stalks, and invites a growth of weeds. Heavy seeding makes finer stalks, and nicer hay for cows or sheep. There are extremes in both directions, and both should be avoided. For pastures, we favor sowing several different kinds and using seed with a liberal hand. This is much more important with pastures than with grass which is grown for hay. The pasture remains long in grass, and it is desirable that it should produce as large a quantity as possible. This is aided by the use of several varieties of seed. One kind alone will not furnish as many plants or make as vigorous growth as a mixture of different sorts. Besides, some kinds ripen earlier than others, and by sowing several a succession may be secured, and the pastures be kept green much longer than they otherwise could. Add to these reasons the fact that cattle like a variety of food better than any single kind, and thrive better when furnished with many sorts than they do on one alone, and no further evidence will be needed that it is not wise to seed pasture-land with only one kind of grass. In mowing-lots a larger quantity of hay can be secured and the fields will remain longer in grass, if several kinds of seed are used. But in using these different kinds, a wise selection should be made in order to secure a good quality as well as a large quantity of hay. The varieties which are sowed should ripen at the same time,

and be grown in suitable proportions. For feeding to horses, for at least half of the time, we like Timothy which is grown without admixture of any kind, but for cows and sheep a variety is to be preferred. The following mixtures, with slight changes, are highly recommended by various agricultural authorities. Each mixture is designed for one acre of land.

FOR MOWING-LOTS.

Orchard Grass.....	6 lbs.	Timothy.....	6 lbs.
Red Clover.....	10 "	Red Top.....	4 "
Rye Grass.....	5 lbs.		

FOR PERMANENT PASTURES.

Meadow Foxtail.....	2 lbs.	Rye Grass.....	4 lbs.
Orchard Grass.....	6 "	Timothy.....	4 "
White Clover.....	5 "	Blue Grass.....	4 "
Red Clover.....	4 "	Meadow Fescue.....	4 "
Rough Stalked Meadow Grass	4 "	Red Top.....	4 "

HAY AND PASTURE COMBINED.

Timothy.....	6 lbs.	Wood Meadow Grass.....	4 lbs.
June Grass.....	4 "	White Clover.....	4 "
Orchard Grass.....	4 "	Perennial Clover.....	2 "
Rye Grass.....	4 "	Rough Stalked Meadow Grass	2 "

Sweet Scented Vernal Grass.....2 lbs.

For the SOUTH MR. HOWARD recommends the following:

FOR ROTATION AND IMPROVING THE SOIL.

Red Clover.....	4 qts.	Orchard Grass.....	1 bu.
Meadow Oat Grass.....	1 bu.		

FOR MEADOW LAND.

Timothy.....	1 pk.	Herds Grass.....	4 qts.
White Clover.....	4 qts.		

Add 4 quarts of Red Clover, if immediate results are desired.

FOR SUMMER PASTURES.

Bermuda Grass.	Crab Grass.	Red Clover.
Herds Grass.	Natural Grasses.	

FOR WINTER PASTURES.

Meadow Oat Grass.....	1 bu.	Blue Grass.....	4 qts.
Orchard Grass.....	1 "	Red Clover.....	4 "
Wild Rye Grass.....	1 "	White Clover.....	4 "

Not to be grazed later than June or earlier than Christmas.

For mowings at the NORTH we favor a much more liberal use of Timothy than any of the tables given above require. In

connection with Red Top and Meadow Fescue for moist land, and with Orchard Grass and Clover for early cutting on dry soils, we consider it almost invaluable. It has been asserted that this grass will not thrive on dry uplands, but our experience with it upon these soils has been quite satisfactory. It has a bulbous root, and, on this account, is more liable than some grasses to be injured by extremely dry weather if it comes immediately after the hay crop is removed. We do not favor cutting this grass as close to the ground as is sometimes done. Neither should it be allowed to ripen its seed unless the land is soon to be plowed. When cut in the blossom and properly cured it makes splendid hay, and we have no hesitation in recommending it for extensive cultivation.

The care of permanent grass fields, or fields which for several years are to be kept in grass, is very simple. It is one of the great merits of the grass crop that it can be grown with but very slight expense for labor, and with only a moderate quantity of manure. The main things to be done are to give suitable protection, avoid too close cutting, and provide a reasonable quantity of plant-food. Mowing-lots ought never to be grazed. To neglect of this rule a large part of the partial failures with the grass crop are due. In NEW ENGLAND it is a very common practice to mow the grass as soon as ripe; a few weeks later, if there is enough to make it an object to do so, the rowen is cut very close to the ground, and early in the fall the cattle are turned into the fields and allowed to gnaw the grass to the roots until the ground is either frozen or else covered with snow. Thus the grass roots must endure the rigors of a NORTHERN winter without other protection than the snow. This frequently does not fall until after the ground has been severely frozen and the roots seriously injured. No other crop could endure a tenth of the exposure, neglect, and abuse which the grass receives, and maintain its hold upon life. Yet farmers expect their grass to not only live, but also to yield them a large profit. It

ought not to be a matter for surprise that when treated in this manner grass lots do not long yield good crops. It is a wonder that they prove so permanent when subjected to such adverse influences. Then, too, the average farmer robs his grass land to feed his hoed crops. The hay is fed out on the farm in order that it may furnish a supply of manure. But when the manure is obtained it is not returned to the grass fields from whence it came, but almost all of it is used on the hoed crops. Year after year the drain goes on. It is true that after the hoed crops are removed grass is grown on the land to which the manure was applied, but the hoed crops have taken nearly all of it, sometimes every particle of it, from the soil. In some cases the grass obtains a degree of benefit from the manure, while in others the land is not in as good condition for the production of this crop as it would have been if no manure had been used and no other crops grown. It sometimes happens that a little manure is left after the other crops are provided for. When this is the case the surplus is spread upon the grass. Frequently the poorest manure is used for this purpose, and only a very slight coating is applied. Such is the too common custom of farmers at the NORTH. There are many in all, but few comparatively, who pursue a much more liberal policy.

It is very true that grass obtains much of its material from the air. But this is also true of corn and other hoed crops. All good farmers know that it is not wise to grow corn without manure. For the same reasons which apply to the production of corn, the grass crop should not be grown without the use of fertilizers. Both mowing-lots and pastures should be occasionally manured. If the latter can be plowed and occasionally seeded, it will be a great benefit except in cases of the fields, which are occasionally seen, in which the best qualities of grass are productive and permanent, and which would be injured instead of improved by reseeding. On all pastures which it is not desirable to plow, manure of some kind (generally com-

mercial fertilizers, such as the special manures made for this crop, guano, plaster, and ashes) should be occasionally used. If these are applied when the cattle are in the fields, care must be taken to use those which will not prove injurious if eaten. In ENGLAND some very fine cattle have been poisoned by fertilizers used in the pastures. If there is any doubt about this matter it will be wise to sow the fertilizers in the fall, after the cattle have been

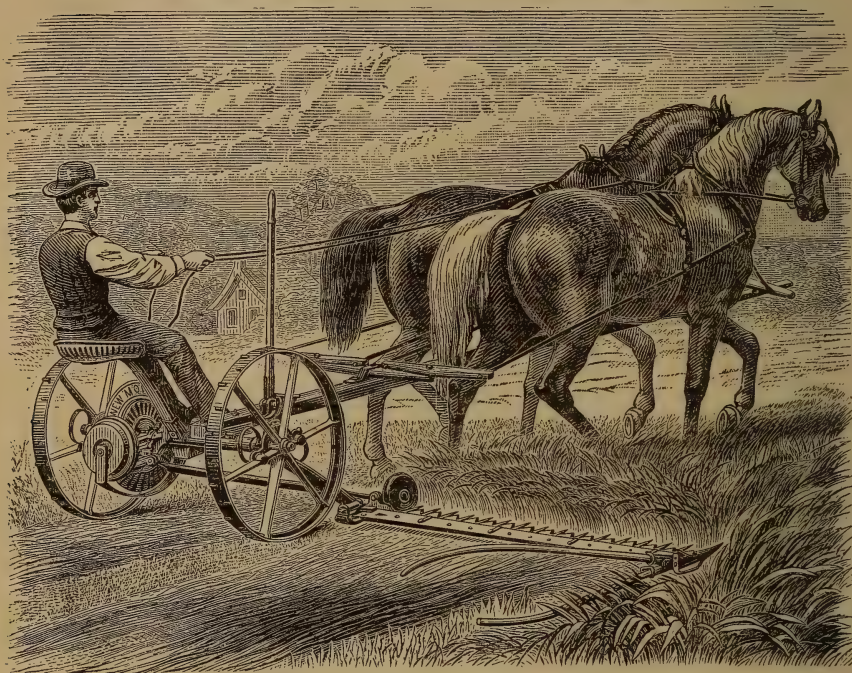


FIG. 39.—BUCKEYE MOWER.

taken out for the winter, or to use only small quantities at a time and apply just before a heavy rain, keeping the cattle off until the rain has dissolved, and carried down the fertilizers to the roots of the plants.

Upon mowing-lots the manure can be applied late in the fall or early in the spring. We consider the former decidedly the best time for using yard-manure. The frost will crumble the lumps, if there are any, and the manure will prove a protection

to the roots. The dissolving snow will carry it down to the roots very early in the season—just when it is needed to make a quick and vigorous growth. If the manuring is delayed until spring, the land is usually soft and is badly tracked by the teams and cut by the wheels. There is danger that it will not be attended to early enough to give the best results, and the pressure of work is so great that the manure will be more likely to be left in lumps than it will if the less hurrying time of autumn is chosen. With commercial fertilizers we think it makes less difference, but prefer using them late in the fall upon all lands not liable to be washed. It is better to use manure in moderate quantities quite often than it is to make larger applications at long intervals. If the grass fails to return large crops when it is well manured the land should be plowed at once and reseeded. Grubs may be eating off the roots, or it may have become turf-bound. In either case a fresh seeding is desirable.

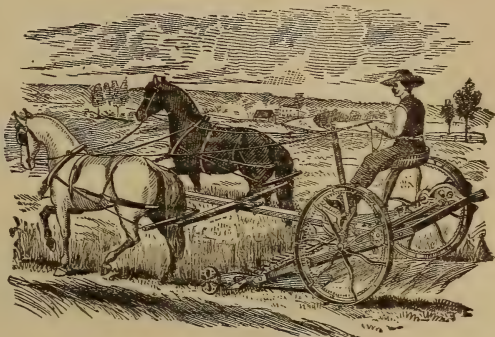


FIG. 40.—EUREKA MOWER.

Extremely close cutting of the grass crop should be avoided. On dry land, and particularly in a dry season, Timothy should be cut rather high. The rowen crop is often shaved close to the ground. Such close cutting late in the season, when the plant has been struggling for life since the first crop was taken off, is very injurious. It need not be cut extremely high, but it ought never to be cut very close to the ground.

Pasturing mowings in the fall is a ruinous practice. A little grass is obtained and the cattle are kept along upon it for a few weeks when they would, but for this, have to be fed at the barn. But by this means the roots of the grass are left unprotected

through the winter and many of the plants are destroyed. Others are enfeebled so that they can produce only a small quantity of grass the succeeding year. The late growth ought to be allowed to remain, fall down, and cover the roots. It is a protection which nature designed and which ought always to be given. It is much better for the farmer to grow an extra quantity of fodder crops, to be used both green and dry, and keep his cattle out of the mowings, than it is to turn his grass land into pasture in the fall. That this can be done easily and profitably some of our best farmers have proved by many practical tests. MR. CHEEVER, of the NEW ENGLAND FARMER, has not allowed cattle in his meadows for twenty years. Many other farmers, in different sections, have tried the plan for less time but with uniformly good results.

A few words concerning the cutting and curing of the hay crop should find a place in this connection. Except when grown specially for seed, grass should be cut before the seed has matured. As a general rule, grass is at its best when in the blossom. If cut much sooner it is very watery and innutritious. If allowed to stand much longer it becomes woody and much of it is indigestible. Ripening the seed is also a severe drain upon the energies of the plant, and proves fully as exhausting as all of its previous growth. For this reason land upon which grass stands very late often fails to produce good crops for several successive seasons. The only hope of securing permanence on fields which are treated in this way is to keep them very rich and allow considerable of the seed which is formed to shell upon the ground. At the NORTH there has been a great change in the time of cutting the hay crop. Twenty years ago but very little grass was cut until after the fourth of July. Now large quantities are cut in June, and some farmers get in nearly their whole crop in this month.

Fine weather is one of the great essentials of success in curing the hay crop. Too many farmers work in cloudy weather the

same as when it is fair. It is much better to work in the corn fields or attend to some other crop. In cloudy weather hay dries very slowly and is likely to be got in without sufficient curing. There is also liability of rain, which is always injurious to grass which is partially dry. As a help in deciding upon the weather, the farmer should have a barometer and thermometer, and should be a careful observer of the sky and clouds. It is to be hoped that the GOVERNMENT will also establish signal

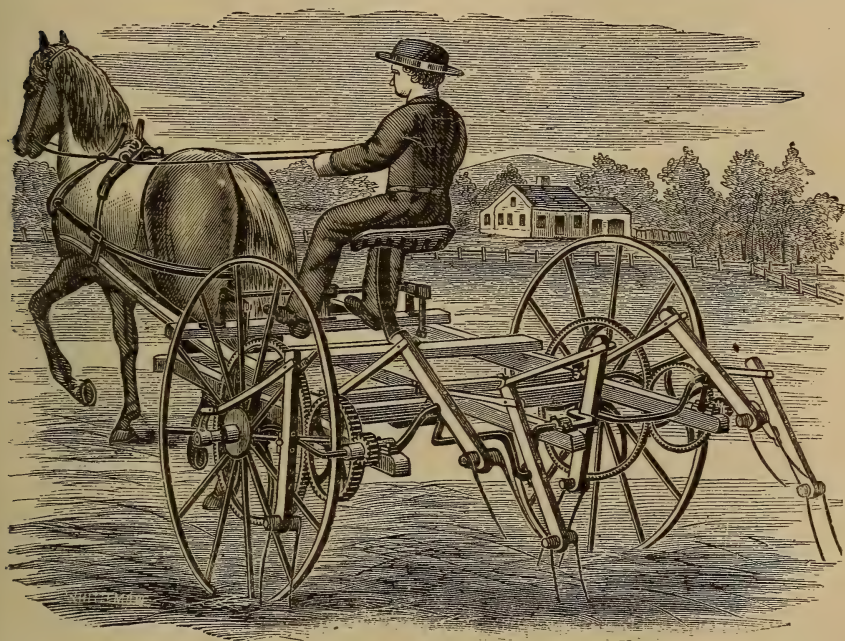


FIG. 41.—THE BULLARD HAY-TEDDER.

stations in the great agricultural districts (similar to those for navigators on the great lakes and the ocean), which, during the harvest seasons, may furnish the farmers with the results of scientific observation.

It is not well to attempt too much at a time. Cut only what can be properly managed. Upon Saturday attempt less than upon other days, so that the work may all be finished in good season. For cutting the grass use a good mowing-machine.

Figure 39 represents the Buckeye Mower manufactured by Ariance, Platt & Co., of New York city. This machine is simple, safe, strong, and very durable. It draws easily and does perfect work. Figure 40 shows the Eureka Mower, made by the Eureka Mower Co., Towanda, Pa. This is a "direct draft" machine, the cutting apparatus as well as the gears being directly behind the team. It cuts a wide swath, does good work, and is very highly commended by those who have given it a practical test.

Grass dries much more rapidly if cut after the dew is off than it will if it is wet when the mowing is done. During the first part of the season two days will be needed for properly curing heavy grass. Later, when the grass is nearly ripe, it can be cured in one.

In order to obtain the best quality of hay, rapid drying will be an absolute necessity. In order to secure this a good Tedder will be found indispensable. Figure 41 represents the Bullard Hay-Tedder, made by the Belcher & Taylor Agricultural Tool Co., of Chicopee Falls, Mass. We have used this machine many years, and found it a splendid implement. It fully deserves the many medals which have been awarded at State and other trials.

After the hay is dry, a horse-rake will be needed for gathering the hay. Figure 42 represents one of the best of the wheel-rakes. It has the best of wire-teeth, can be operated by hand or foot, is simple and strong, and can be managed by any boy who can drive a horse. It is made by B. C. Taylor, Dayton, Ohio. Figure 43 represents a cheaper form of rake. It is harder to operate than the wheel-rakes, but will do good work on land that is reasonably smooth. It is made by the Sterling Manufacturing Co., Sterling, Illinois.

On large farms a hay-loader will be very serviceable. Figure 44 represents a machine of this description, which is made by Stratton & Cullum, Meadville, Pa. With this implement,

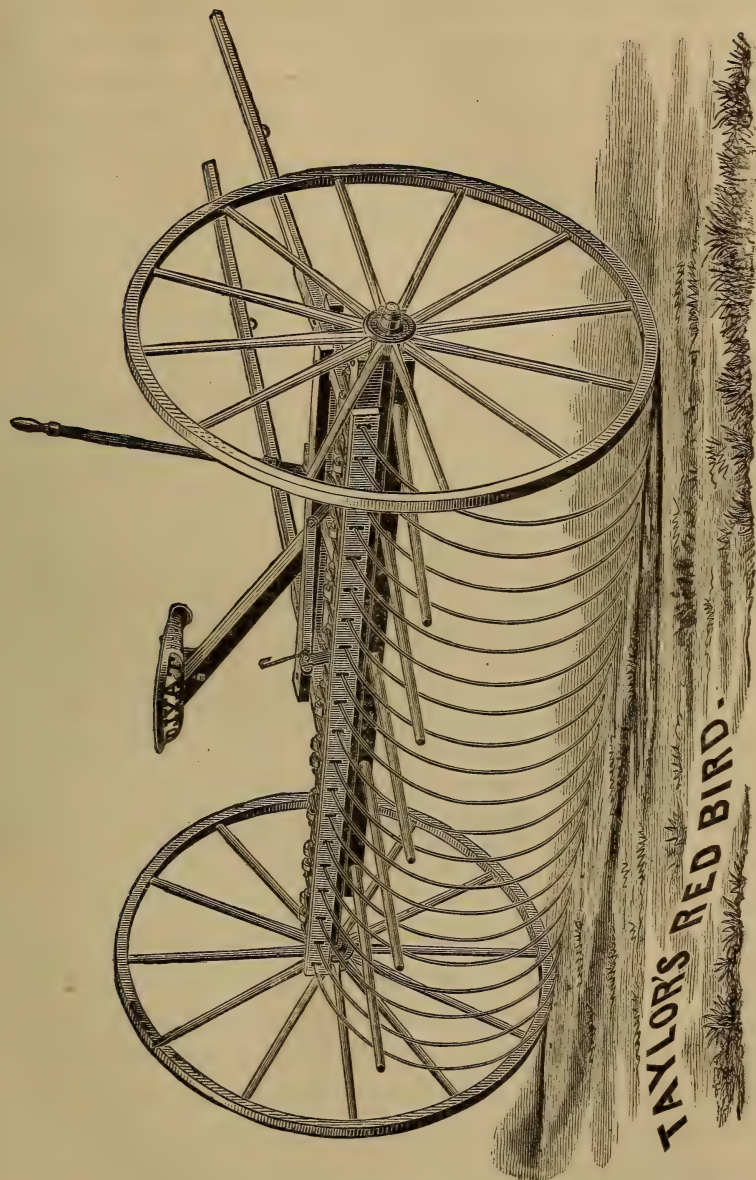


FIG. 42.

which is attached to the rear of the wagon, a ton of hay can be pitched from the windrow in from three to five minutes. By its use a great saving of hard labor is effected, and in showery weather the farmer is often enabled to secure hay which under the old system of gathering by hand would be damaged by rain. A horse-fork for unloading hay at the barn or stack will also prove a very useful implement.

The degree of drying which it receives will greatly modify the quality of the hay. We can remember when hay was dried nearly twice as much as it is now. We think the change which has been made is a great improvement. But we do not believe in getting in hay, or rather grass, without any drying. Too little drying is worse than an excess, as it will cause the

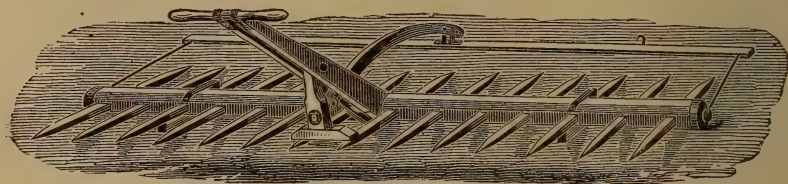


FIG. 43.—STERLING REVOLVING-RAKE.

hay to “smoke,” and it may heat so much as to be utterly ruined. It is best to dry just enough so that the hay will keep well, and come out bright and nice in the spring. All the drying which is given after this point has been reached is a decided injury.

We think barns should always be provided in which to store the hay, though a good workman can stack it so that it will receive but little injury from the weather. For stacking employ a skilful workman, and put up quite a quantity at a time. Instead of drawing from the lot each day, the hay, when nearly dry, may be put into the cock, and allowed to remain until quite a quantity is ready. Then, during a fine day, turn over the cocks so that the dampness in the hay which was near the ground will dry out, and draw to the place where the stack is

to be located. When finished, the top of the stack must be well covered with straw, which should be very carefully put on. Although hay will keep well if properly stacked, we should much prefer, if we could not afford to put up a large one, to build a small barn, and by the use of a hay-press get the whole crop under cover.

Growing grass for seed is a very simple operation. Many farmers who raise their own grass seed do nothing more to the land or crop than the extra work of harvesting. But it is much



FIG. 44.—FOULT'S HAY-LOADER.

better to take special pains to keep the land free from other grasses than the kind of which seed is wanted, and also to keep it liberally manured.

When the seed is ripe, which may be easily known by the changed appearance of the plant, and especially of the heads, the grass should be cut. The cutting may be done with a grain-cradle or a reaper. It should be done in the morning while the dew is on, in order to prevent a waste of the seed by shelling in the field. After moderate drying, it may be put up in small

stooks, and allowed to remain until perfectly cured. Or it can remain unbound until the curing process is complete. In all the operations with this crop, care should be used in order to prevent shelling of the seed. It can be threshed with flails, or shelled with a thresher, and the seed cleaned in a common fanning-mill with a fine screen. The seed is sometimes spoiled by stacking the grass while the stalks are too green. The mass heats enough to destroy the vitality of the seed, though it does not always seriously injure its appearance or prevent its sale. The stalks which have yielded a crop of seed are often fed to horses. As they are tough and woody, they should not be used alone, but fed in connection with better hay and grain. When the tops are cut with a cradle, the stubble may be cut with a mower, and used the same as the tops of the stalks.

BROMUS.—Every little while somebody recommends some member of the bromus family as a forage plant, and sells the seed for high prices. There are several varieties, but none of them are worthy of cultivation, while some of them are to be opposed with as much vigor as the worst weeds with which the farmer is obliged to contend. Of the latter, the common chess, or “cheat,” as it is usually called, is one of the principal sorts. It is a “cheat” in the full sense of the term. Many farmers think that wheat sometimes turns to cheat. This we think is a mistake. It is true that under certain unfavorable conditions the fields which the farmer has sowed with wheat produce nothing but cheat. But it by no means follows that the cheat was grown from the seed which he sowed. He did not sow the seeds of other weeds which appeared in his grain fields, and he is confident that *they* did *not* come from the wheat which he used for seed. He might safely have the same confidence concerning the cheat. A standing offer of quite a sum of money has been made for many years to any one who would produce a quantity of cheat with proof that it was grown from wheat, but the prize has never been awarded for want of evidence that such

a change has occurred. Men have been able to produce cheat upon land sowed with wheat, but they have not been able to prove that it was produced from the seed of the wheat. When an oak forest is removed, a vigorous growth of pine trees often appears. No one sows the seed of the pine, and no pine tree has grown upon the land for generations. Probably the seed had been lying dormant in the soil for a long period, merely waiting for a favorable opportunity to grow. In some such way cheat is doubtless produced. That it can be grown from wheat we consider an impossibility. If the farmer will drain his land, feed his crops, give good culture, and always sow good seed, we think he will never reap a crop of cheat.

As a forage crop the bromus will make quite passable green fodder, considerable hay, and a fair pasture. But once on the farm it will be almost sure to mix with the wheat and spoil it, and will greatly interfere with other crops. It should never be allowed a place upon a cultivated field, and we should not want it in a pasture. There are plenty of other plants which are better for all purposes, and which are free from the objections which lie against this one. Consequently, whether it is recommended under the head of chess, or cheat, or rescue grass, or any other grass or weed, it will be well to let each and every form of this plant entirely alone. The seed has often been sold for high prices and will, probably, be kept in the market by interested parties. Doubtless there are also many farmers who have recommended this plant, in the honest belief that it was a valuable addition to the list of our forage crops. Longer acquaintance will dispel the illusion. MR. FLINT, whose work on grass is a standard, declares that "Not one of the brome grasses is worthy of a moment's attention as a cultivated agricultural grass, and the cleaner the farmer keeps his fields of them, the better." All members of this family should be ranked as weeds to be destroyed, and never treated as plants whose growth is to be encouraged.

CLOVER.—This is one of our most valuable agricultural plants. It is usually called grass, but is a leguminous plant, unlike grass in its appearance and its manner of growth. There are a large number of varieties, of which the Red, White, and Alsike are of the greatest value to the farmers of this country. The red clover is the most extensively grown and is regarded as the standard. Although grown from a small seed, and at first quite tender, it soon becomes a hardy, vigorous plant which sends its long roots down into the subsoil, and spreads its still longer braches above the surface of the land. The seed can be sowed upon the snow in the spring and be allowed to work its way into the soil—with grain in the spring or the fall—or alone, or with other grass in August. It is important that there should be considerable moisture in the surface soil at the time of sowing, and that some protection should be afforded from the heat of the summer sun when the plants are small. It often happens that clover sowed in the spring with grain succeeds better than that which is sowed alone. The grain grows quickly and shades the tender plants from the sun. DR. HARLAN recommends sowing buckwheat with clover when it is desired to grow only the latter. The buckwheat will afford shade while the clover is feeble, and if cut when in the blossom and allowed to remain on the land, will also mulch the clover and prove of great advantage to the crop.

The quantity of seed to be used depends upon the soil and the purpose for which the crop is to be grown. From eight to sixteen pounds may be considered as the extremes. The more seed the finer the stalks, and the better the quality of the hay which can be made from them.

The preparation of the land must be as fine as was recommended for grass seed. Upon this being thoroughly done, success will in a great measure depend.

For fertilizing this crop, both lime and plaster seem to be specifics and to have a wonderful effect. Lime should be

applied to the land as for other crops. The plaster should be sowed upon the plants in the spring when they are a few inches high.

Clover is a biennial, and although, by means of seeds which shell upon the land, it often attains a more permanent character, it is best to plow land which is wholly devoted to this crop once every two years. The soil is then well filled with roots and is in a good condition to be used for the production of grain.

Clover is better suited to dry land than to that which is wet. Its long roots enable it to resist the influence of drought to a high degree. On land which heaves badly in the spring clover cannot well be grown, as the roots will be either thrown out of the soil or else injured so that they will not produce a good crop. Draining will prove an efficient remedy for this difficulty.

Clover should not be pastured when very young. The cutting of a crop for hay should be done when the heads begin to turn brown, but while most of them are green. After the hay is removed, plaster may be sowed upon the land and thus a heavy second growth may be induced. This crop will bear much closer cutting than Timothy. Curing for hay is better accomplished in the cock than by spreading in the sun. If dried in the ordinary way for other crops, many of the leaves will fall off and its value will be greatly reduced. After the mowing has been done the clover should lie long enough to get well wilted, be turned once, in order to wilt the lower side of the swaths, and then put into small cocks which can stand several days. The curing will thus be effected gradually and a valuable quality of fodder will be secured. The day upon which the clover is to be drawn to the barn the cocks should be turned over, so that the dampness may dry from that which was close to the ground. After remaining in the sun a few hours in this inverted position, the clover can be safely put into the barn. In order to prevent injury to this crop by untimely rains, the farmer should provide a quantity of hay caps with which to protect the clover during

bad weather which may occur while it is standing in the cock. These caps will also prove useful in protecting the hay crop.

When clover seed is to be grown, the first crop should be cut quite early, and no plaster should be used upon the land after its removal. When two-thirds of the heads of the second growth are brown the crop should be harvested. This can be effected with a machine for the purpose which simply removes the heads, or the cutting can be done the same as it is with the grass crop. It should be cured as soon as possible, without much stirring, and then taken to the barn. The threshing can be done with flails, but a threshing-machine—especially a clover huller and

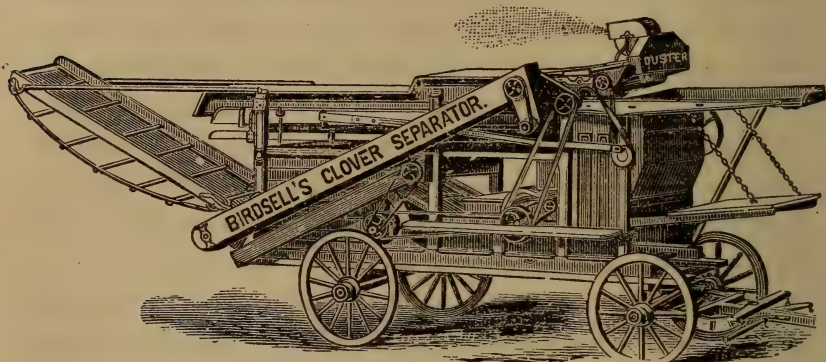


FIG. 45.

separator—is very much better. Figure 45 represents a standard machine for this purpose. It is made by the Birdsell Manufacturing Co., South Bend, Indiana.

Of the value of this crop for a fertilizer we have already spoken. But comparatively few farmers yet realize its immense importance for this purpose or have even a faint conception of the ease with which they might by its aid enrich their land. That it is destined to become extremely popular we have not the slightest doubt. Farmers who have neglected it thus far should lose no more time in testing its efficacy and proving its value.

The white clover is quite useful at the SOUTH for cutting and

curing. Either alone or mixed with various kinds of grass it will yield quite a quantity of excellent hay. At the NORTH it is chiefly valuable as a pasture plant, though in connection with grass it is often used for hay. The quality of grass and hay afforded by it is superior to that of red clover. The white clover pastures are among the most valuable which can be found. Upon dairy farms they are especially prized, while for sheep and lambs they have no superior.

The Alsike clover is a perennial plant which was introduced from SWEDEN into this country, and from which much was hoped. But the expectations of its friends do not seem to have been realized. Although it succeeds well in some localities, it has not become generally popular, and probably will always hold an inferior position. It seems to be an intermediate variety between the red and the white clover, and was supposed to be very hardy and also to be well adapted to wet soils. We have tried it only on a small scale and have not been successful in its cultivation upon either dry or wet land. It will be well to try it as an experiment, but we do not recommend any one to attempt its cultivation on a large scale without first testing it on a small one. If it does well in a small field it can then be sowed in a large one. If it does not thrive, the small field will be large enough. Still, it may be best to try it more than one season, as it may, on account of some peculiarity of the weather, fail sometimes in localities where it will usually prove very successful.

GRAIN CROPS.—Several of the crops which are usually grown for their grain are often sowed for the fodder which they will produce. The value of corn as a fodder crop we have already considered. Rye and oats are extensively grown for this purpose. Rye is usually fed green and furnishes an excellent substitute for grass. It should be used before the heads appear. A constant supply through the growing season may be obtained by sowing in the fall for early spring feeding, and in the spring;

at various times, for summer use. Oats make excellent fodder if cut when in blossom and cured like hay. Peas are also good for feeding green or curing for winter fodder. The preparation of the land for these crops should be the same as when grown for their seeds. As a general rule, a larger quantity of seed should be sowed, and the crop must always be harvested earlier in the season. The great objection to these crops for feeding purposes is to be found in the fact that the plants are annuals, and, consequently, the seeds must be sown every year, while considerable preparation of the land must be made before the sowing can be done.

LUCERNE.—This is a perennial plant which flourishes in warm climates and rich, deep soils. The roots grow long and large, and when once started in a favorable location the plants will produce an immense amount of fodder for many successive years. Under the various names of Lucerne, French Clover, Brazilian Clover, and Alfalfa, this plant has been introduced into this country from foreign lands. In CALIFORNIA and the SOUTH it gives splendid results. MR. HOWARD considers it “very far superior to all others” as a forage plant in the SOUTHERN States. At the NORTH, Lucerne does not always succeed. The climate is not adapted to its culture. Still, it has been grown in MAINE, and with sufficient care it can, probably, be produced in nearly all the States. But the disadvantages under which it labors at the NORTH are too great to justify an effort for its extensive cultivation. At the SOUTH it should be largely grown.

Lucerne may be fed either green or in the form of hay. When used green it ought always to be cut a day or two before it is wanted in order that it may have time to wilt. It is very nutritious. Horses, cattle, and even hogs thrive when fed upon it in its green state, and all animals that eat hay not only like it but do well when fed upon it after it has been dried.

For this crop the land should be well prepared. It is best during the year preceding the sowing of Lucerne to grow some

crop which requires clean culture. This in order that the weeds and grass already in the land may be eradicated. The soil should be reasonably dry and the ground deeply plowed. If sub-soiled it will be all the better. A heavy coating of well-rotted yard-manure, or a liberal application of bone-dust, gypsum, or ashes should be harrowed in and the surface soil should be made very fine. Rich land and thorough preparation are essential to success.

The seed should be sowed in February at the SOUTH, and as late as May if an attempt is made to cultivate this crop at the NORTH. It may be scattered broadcast or sowed in drills. As it is a feeble plant when small it is better, unless the land is very free from weeds and grass, to put it in drills about a foot apart. If in drills it can receive cultivation whenever needed. If sown in this way, from eight to ten pounds of seed should be used. If sown broadcast, from twelve to sixteen pounds will be required. It should be lightly covered with a roller or a bush-harrow. If put in with a good seed-sower, or drill, the machine will cover it sufficiently. If weeds or grass appear they should be removed, and it will pay to stir the soil, occasionally, between the drills. Manure should be applied every third year. It can be worked in with a small plow if the plant is grown in drills. If the land remains mellow the fertilizer may be left on top of the soil where the sowing was broadcast, but if the surface becomes hard a harrow should be used for covering the manure.

The cutting should always be done as soon as the plant blossoms. If longer delayed, the quantity of fodder will be increased, but the quality will be badly impaired. If at any time the tops turn yellow, the cutting should be done at once. The curing of Lucerne for hay is to be done as directed for clover. Long exposure to the sunlight is injurious to its quality, and will cause the loss of a large proportion of the leaves.

This plant requires three years in which to attain its full development, but yields exceedingly large crops the first season.

When well established, on rich land and with good culture, its yield is enormous. It should never be pastured, as cattle and horses will destroy the plants, but should be kept to furnish either green fodder, or hay, to be used at the barn or the feeding yards.

MILLET.—Of this plant there are several varieties. Of these the one commonly called Hungarian Grass has been the most extensively grown in this country. It is a rapid and rank-growing annual, producing large quantities of green food, hay, or seed. We have only grown it for hay. The Golden millet is recommended as greatly superior, while the newer introduction under the names of Egyptian, East Indian, or Pearl, millet promises to be still better. It may be sowed in drills, or broadcast. The land should be rich, well fertilized, and the surface should be made very fine and mellow. The sowing should not be done until the nights are warm. At the NORTH the last of June is generally a favorable time. If sowed broadcast from a bushel to a bushel and a half of seed should be used. This will give a better quality of fodder than can be obtained from thin seeding. The Egyptian millet, however, is said to tiller extensively. This should be sowed in drills. Only two or three quarts of seed will be required per acre. The common millet will be ready for cutting in from four to six weeks after the seed is sowed. It can be cut with a mowing-machine and dried the same as common hay. Horses like the hay made from this plant, and will fatten rapidly when kept upon it. But it is very rich food, and growers generally prefer to mix it with common hay. This is especially true after it has gone to seed. Then it should be fed in only small quantities, as a large amount will be as injurious as so much unthreshed wheat. It should be cut before the seed is ripe, but not until the heads are well formed. For green food it can be cut during its various stages of growth. While the sowing should not be done until the weather is quite warm (both during the day and at night) it

must not be so long delayed as to expose the crop to the influence of the early autumn frosts. As it produces a heavy yield this crop should be harvested while the days are warm and long. We not only esteem this plant for its value as forage, both for horses and cattle, but also on account of the time of the year at which it may be sown. If for any reason the hay crop comes in light, the farmer can turn over a few acres of sod, make the surface mellow, apply fertilizers, and by means of sowing this crop he can fill his barns to overflowing with an excellent quality of dry fodder. By this method he can *always* grow fodder enough to keep his stock through the winter. While nearly all other crops must be put in early, with this one the farmer can wait until he knows the amount of his hay crop, and he can then sow much or little according as the yield of the ordinary grass shall be light or heavy.

The principal objections to this plant are, that, being an annual, the ground must be prepared, and the seed must be sowed each year, and the danger attending the feeding of large quantities after the seeds are ripe. But these objections will weigh very lightly with a farmer who has once grown this crop. Its great value will far more than repay all the labor required, and the danger may all be avoided by cutting before the seeds are ripe, or by feeding but small quantities at a time. For NORTHERN farmers we recommend this plant as worthy of extensive cultivation.

PRICKLY COMFREY.—Of this claimant of popular favor as a forage plant we have but little to say. Our own efforts to grow it resulted in complete failure, as the cuttings appear to have lost their vitality before they were planted. This variety of the comfrey is "a hardy perennial of gigantic growth," and was introduced into ENGLAND, from CAUCASUS, as an ornamental plant. After a while it engaged the attention of agricultural writers, and was grown to some extent for the purposes of forage. It was introduced into this country, and for the past four years

has been extensively advertised. That it will produce an immense amount of fodder per acre, take full possession of the land, survive extremes of heat and cold, drought and moisture, and resist the encroachments of all other plants, there is no doubt. It comes early in the season and remains very late. It is propagated from the roots, which can be cut in small pieces and planted like corn, at any time except during cold weather. It should be grown in rows, three feet and a half apart, with the plants about three feet apart in the row. About four thousand plants per acre will thus be furnished, and will produce, on good land, from eighty to one hundred and twenty tons of green fodder per year. Parties interested in its sale assert that the leaves are very valuable for feeding purposes, both for increasing the milk of cows and fattening stock. Some who have tried its merits speak favorably of it, but many have complained that their cows would not eat the leaves as long as they could find anything else to eat, and that when eaten the plants seemed to do no good. Probably after the leaves get very large they are not as palatable as they are when they are small.

There are certain objections to this plant. Once in the land it remains like so much dock. It costs considerable to start a field, and it is only with great difficulty that it can be eradicated if the land is ever needed for any other purpose. But it will afford several cuttings each season, and in dry years it will prove of special value for furnishing an abundance of green food. If the cattle will not eat it, there will of course be no benefit from growing the crop. We think that most cattle will soon learn to eat it, but there may be instances in which the dislike is too strong to be overcome. Whether it will pay the farmer to grow this crop will depend upon the character of his land, and also upon the other resources for green fodder which he can command. If cattle will eat the leaves, there are sections in which this plant will prove of great value. In all cases, if tried at all, it should be tried upon a small scale. If the first

experiment proves successful, a larger area of land can soon be devoted to the crop. But if the cattle do not like the plants, there will be little inducement for extending its cultivation.

ROOT CROPS.—These are among the “main stays” of the ENGLISH farmers, and are gradually winning their way into the confidence of farmers in our own land. For farmers, wherever located, who are largely interested in stock-growing, these crops are of special value. It is not safe to argue that because the ENGLISH find root crops indispensable, therefore they must be grown by AMERICAN farmers who desire to be successful. Our climate and soil are so different from theirs, that what will be the best crops for ENGLISH farmers may *not* be the best for farmers here. The argument for the production of root crops must be based upon different grounds than the fact that they are very successfully grown in other countries. But there are plenty of reasons why our farmers should devote more attention to these crops than they have done in past years. For use as an exclusive, or even as a principal, article of diet for animals, roots are not recommended. But our long winters make it highly important that a certain proportion of green food should be given. For fattening animals roots are not as good as corn, and it is very probable that the ENGLISH farmers would not devote as much attention to the growth of roots as they now do if they were able to grow corn. In this country hogs have been fed too exclusively on corn, and cows and steers have been limited too closely to hay and meal. Experiments have proved, what the physiologists have long asserted, that the fattening effects of farinaceous food are much greater when it is used in connection with a liberal proportion of succulent material than they are when this food is used alone. Dairymen have found that they can make more and better butter in winter when they feed roots to their cows than they can when only hay, meal and bran are used. The color of the butter is also greatly improved by the addition of roots to the diet of the cows.

Roots take the place of grass to a great extent, and by their use cows can be kept very productive during the cold weather. The constipation which so often attends the long-continued use of dry hay is wholly avoided by the addition of roots to the diet. The health of animals is promoted by the use of roots in connection with hay, and for this reason alone, if there were no other, stock-owners would find it for their interest to grow them. This, in connection with the facts that immense quantities can be grown on small areas of land, and that roots contain a fair proportion of fat and flesh formers, furnishes an unanswerable argument in favor of the production of these crops upon each and every farm. The amount of land which should be given to root crops will depend upon the amount of stock which is kept, the character of the land, and the circumstances of the farmer; but there are very few men who cultivate the soil who cannot profitably devote part of their time and land to the growth of roots. These crops can be grown so as to improve the cattle to which they are fed, increase the value of the land upon which they are grown, and also promote the financial interests of the farmer. The crops belonging to this class which can be successfully grown in this country are not many in number, though they are of great importance. The leading ones we will briefly consider.

ARTICHOKE.—This crop is used both for its roots, or tubers, and also for its stalks, though it is for the former that it is principally grown. The quality of the roots is somewhat lower than that of some of the other crops of this class, but the immense yield of the artichoke makes it a very profitable one to produce. Still the analysis of this root shows that it contains considerable nutritive matter. And the fact that all kinds of stock do well when they are furnished with a reasonable quantity of artichokes fully sustains the conclusion which has been drawn from the analysis. An immense amount of food may be grown upon an acre of land. And with this crop

there is one advantage which most others do not possess: it can be harvested by the hogs, and thus considerable labor may be saved.

For this crop the land should be deeply plowed and well harrowed. It should be marked with a small plow, in rows four feet apart. The hills may be from two to four feet apart. Manure may be spread broadcast and harrowed in before the marking is done, or it may be put in the hills. Still the artichoke will thrive, and is very often grown, without the use of fertilizers of any kind. Only a small quantity of seed will be required. Three bushels per acre will be sufficient. The roots should be cut into small pieces, and not more than two of these should be put in a hill. The covering may be done with a light plow, or with a hand-hoe, and need not be very deep. The planting should be done early—as soon as the ground is warm. When the plants are a few inches high, they should be either plowed or cultivated, and hoed. During the season three or four more plowings should be given. In August the plants blossom, and very soon afterwards the tubers begin to form. The growth is very rapid, and continues until frost kills the stalks or they are cut down.

The stalks are sometimes cured and used for fodder, but are generally cut and burned. The harvesting of the roots is done easiest with a plow, which should run deeply and turn all of the land. By covering with earth they can be kept during the winter in a common cellar, or in trenches. When grown specially for hogs they should be in a lot which is enclosed, into which the hogs can be turned and allowed to do their own harvesting. Those which are not used in the fall will be good in the spring.

It is the best way to plant every year, though many growers start a plantation and allow the hogs to gather what they choose. In the spring a large number of plants will appear. These are sometimes allowed to grow as they spring up. Some growers

plow through the fields so as to leave the plants standing in rows. This is much better than it is to leave them all over the land.

There are several varieties. Of these the JERUSALEM is largely grown, though it is an inferior sort. The best kinds are the RED BRAZILIAN and the IMPROVED WHITE FRENCH. In color and general appearance the former closely resembles the JERUSALEM, but is much better in quality and a great deal more productive. The yield varies greatly, but on good land which is well cultivated is always large. Eight hundred bushels per acre are often grown, twelve hundred are occasionally reported, and as high as two thousand bushels have been claimed.

When fed freely with artichokes, hogs will both grow and fatten. One experiment which has been reported claims a gain of nearly two pounds per day for each hog. Milch cows and sheep do well when fed upon the roots and stalks. The health of all animals which are fed upon artichokes seems to be promoted by their use.

It is sometimes objected to this crop that it is very difficult to eradicate. But this need not prove a serious matter. If the habits of the plant are understood, it can be easily destroyed. By mowing them during the last week in August, most of the plants will be killed. Or they can be destroyed by plowing the land when they are about a foot high.

BET.—Of this vegetable there are many varieties which are excellent for the table, and a few which are of special value for feeding to stock. Some growers prefer the former to the latter kinds, even for feeding purposes. The fine varieties can be grown, it is said, as cheaply as potatoes, and the same area of land will produce four times as many bushels. For these varieties, when grown for cattle, the land should be plowed in the fall, in order that the surface may be made fine by the frost. In the spring some fine manure should be spread, in liberal quan-

tities, upon the surface and harrowed in. If yard-manure is not to be had, bone dust, superphosphate, or guano, may be used in its stead. The surface soil must be made extremely fine. About the middle of May the seed should be sown in rows about fifteen inches apart. The seed ought to be covered to a depth of one and a half or two inches. Four pounds per acre will be a sufficient quantity. As soon as the plants come up, the wheel-hoe should be run between the rows, and weeds close to the plants must be removed by hand. Early weeding is important, and when they are small the plants are benefited by stirring the ground. When a few inches high they should be thinned to from four to six inches apart. Care must be taken not to cut the roots or injure the leaves.

When growing in large quantities the preparation of the land should be the same as above described, unless the long kinds are produced. In this case the manure may be covered, at the second plowing, to a depth of four or five inches, and the rows may be from eighteen to thirty inches apart. At the latter distance horse-power can be used in the cultivation of the crop. As soon as the beets are well up, the cultivator should be run between the rows and a light steel hoe should be used to loosen the dirt close to the plants. When they are a few inches high, the thinning should be performed and vacant places should be filled by transplanting. The plants should be left only ten or twelve inches apart. This will allow the production of only moderate-sized specimens, but the quality will be far superior to that of very large roots. Some growers recommend the sowing of from five to ten bushels of salt per acre, or a mixture of salt and plaster, when the fourth leaf appears. Most of the thinning can be done with a hoe. Until the leaves get quite large, frequent cultivation should be given. When ripe, or there is danger of frost, the crop should be harvested. The leaves furnish good food for cows.

Mangold Wurtzel is a variety of the beet which is largely

grown for stock. The roots grow to a large size and are "coarse in structure," but are formed of the same materials as ordinary beets. Whether they will furnish more nutritive matter per acre than some of the finer varieties of the beet is a question which is in dispute.

When harvested, the beets, or mangolds, may be put into a cool cellar, in piles two or three feet in depth, and lightly covered with earth, or they may be stored in pits or trenches, as already described for potatoes and sugar beets.

It is not well to feed mangolds until the middle of winter, as a ripening process goes on until about that time, and the starch which they contain is converted into sugar. They should be fed after the turnips (if any are grown) are used, and at first only small quantities should be given at a time.

CHUFA.—This plant belongs to the sedge family and has its home near the MEDITERRANEAN SEA. It is cultivated for its "nut-like, sweet-tasted" tubers, or roots, which are called chufa. There are many varieties. Some of them are considered pernicious weeds, as they multiply rapidly by means of the tubers. These plants are hard to eradicate, especially from the sandy soil of the SOUTH. The "coco grass," which is there common, and also detested, belongs to this class of plants. The best variety (we think that only one sort is extensively grown in this country) is very prolific, is easily grown, and furnishes a good quality of food for hogs or poultry.

The land should be well plowed and harrowed. The tubers may be planted in rows two feet apart, and one foot apart in the row. One tuber should be placed in each hill, and covered two inches deep. The planting should be done at the same time as it is for corn. When small the weeds must be kept down, and during the season the cultivator should be run between the rows several times. This crop thrives best at the SOUTH, and is not at all to be recommended for NORTHERN cultivation.

CARROT.—This is one of the best of the roots which are

grown for feeding to stock. When young the plants are quite feeble, but they are liable to but few diseases, and can be grown without great difficulty. The roots are much superior to the common turnips, and better than the ruta бага. If the land is well manured, this crop can be grown upon the same field for many successive years. Carrots are of great value for feeding to horses. The effect of these roots upon the digestive organs is excellent, and they give a sleek appearance to the coat. They promote the health of all animals to which they are fed. Their laxative properties are beneficial, and tend to counteract the constipating tendencies of exclusive feeding with dry hay. When fed to cows carrots improve the quality of the milk, and increase its quantity. The color of the butter which is produced is much richer than that which is made from cows which are fed with dry hay, and, when other things are favorable, its quality is very fine.

Carrots should be grown upon good land which is free from stones, and which is neither wet nor very dry. It must be made quite rich, but most of the manure should be applied in the fall. The plowing should be very deep, but the manure ought to be used upon the surface. Both the manure and the surface soil should be made extremely fine. Bone-flour, superphosphate, or guano, may be applied in the spring in addition to the yard-manure which is used in the fall, or may be used in case of a deficiency in the quantity of that material. The land should be plowed early in the spring, and plowed again just before time for sowing the seed. This in order to kill the weeds and pulverize the soil.

The sowing may be done from the tenth of May until the tenth of June. On some accounts early sowing is to be preferred, while on others it is better to sow rather late. The plants are weak when they first come up, and if the ground is dry and the sun extremely hot they are liable to be destroyed. But if the seed of the early sorts is put in early in the season,

the carrots are likely to ripen too soon, and to decay during the winter. The rows may be only twelve inches apart for the small kinds, and fifteen for the large varieties. One and a half pounds of seed, if it is fresh and good, is sufficient for an acre. But much of the carrot seed which is sold is poor, and four pounds per acre are used by some growers of this crop.

As soon as the plants come up, the wheel-hoe should be run as close to the rows as possible, and all necessary weeding must be given. During the season frequent hoeings and weedings should be given as they are required. When the plants are small they should be thinned to three or four inches apart. No weeds should be allowed to get a start, and if any of the carrots show a disposition to go to seed, the stalks should either be cut off, or else the roots must be pulled and thrown away.

There are several varieties possessing very different qualities, and ripening at different periods. Of these we think the following are the best for cultivation on the farm. The Early Short Scarlet Horn is very early, and of quite good quality. The roots are short, but on good land quite a yield can be secured. The Short Horn is a similar variety, but a little longer and later. The Long Orange is one of the most popular varieties which has been introduced. It has long been a standard sort. Both the quality and color are very good. The greatest trouble is with the length of the roots. Being very long the labor of digging is much greater than that of harvesting the short kinds. The Danvers carrot is an intermediate variety which has been established by the large growers in DANVERS, MASS. It is longer than the Short Horns, but shorter than the Long Orange. The roots are smooth and handsome, and of a rich orange color. From twenty to forty tons per acre can be grown. This is destined to be a very popular variety. The Large White Belgian is a large variety which is grown exclusively for stock. It yields largely, but the quality is poor, and we think it will pay much better to grow some of the other varieties which have been named.

The harvesting should be done as soon as the tops indicate that the plants are matured. If the weather is cold and there is danger that the ground will freeze, this work may be done before the roots attain their full growth. The tops should be cut with a light, sharp hoe. If a little of the crown is removed, the roots will keep just as well and not be quite as likely to sprout in the winter. They may be dug with a fork, or a plow may be run close to each row and the roots pulled by hand. We have sometimes pulled the Short Horn carrots without either digging or plowing.

Carrots should be stored in a cellar which is cool and dry, in piles not more than two and a half feet deep. They should not be placed upon the damp ground, but should always be laid in bins or upon a floor. Probably they can be kept in trenches in the ground if they are stored in only small quantities and are fully protected from the damp and frost.

When seed is to be grown, the best roots should be selected—those which are of good form and color—and set out by the middle of April if danger from freezing is past. The land should be deeply plowed, and, if the roots are long, holes may be made for them with an iron bar. The rows should be three and a half feet apart, and the roots placed a foot and a half apart in the row. The roots should be set deep enough to bring the crowns even with the surface of the ground. During the season they should be hoed occasionally and all weeds should be kept down. The seed ripens unevenly and will need cutting at different times. When the branches become dry, and the seeds turn brown, the heads should be cut with shears and stored in a cool, dry room.

Carrots should be run through a root-cutter before they are fed, and should always be put in the mangers. Cattle will eat them if they are cut and spread upon the grass. But it is much better to put cattle into the stable before giving them roots of any kind. If the roots are put in the mangers, cattle will eat

them quietly and will not be as likely to get choked as they will if fed in the field.

PARSNIP.—This crop is not as extensively grown as it should be by those who make a business of growing roots. It is excellent for feeding to stock, and is one of the best of all roots to keep late in the spring. The parsnip should be grown on good land which is heavily manured, deeply plowed, and thoroughly pulverized. The seed may be sown either early or late in the season, but is likely to fail if the weather is very hot and the ground very dry. As a general rule, moderately early sowing will give the best results. The seeds are rather weak, and, on this account, should be thickly sown. The cultivation should be the same as has been recommended for carrots. The harvesting should be done late in the fall, though all the roots which are to be used in the spring may remain in the ground until that time.

For seed-growing the same process should be pursued as is taken with carrots. Like the carrot, parsnip seed ripens unevenly, and several cuttings will be needed. Two seeds grow together. When they separate they are ripe, and the heads should be cut and spread in a cool loft to dry. With this crop, rich land and care in the early stages of the growth of the plants will be required in order to obtain a good yield.

TURNIP.—This is the most extensively grown of all the root crops, and is very popular in EUROPE as well as in the root-growing sections of this country. Both the common turnip and the ruta бага are great favorites with nearly all those farmers who grow root crops. While they may be advantageously grown, we do not think that they should be produced to the exclusion of all the other roots which have been named. They are of special value for feeding to sheep. For cows and horses carrots are much better.

It is best to plow the land to a medium depth about the time of plowing for corn, to harrow it occasionally in order to destroy

all the weeds, and then plow it again when it is time to put in the seed. Many growers omit the first plowing, but it ought to be given. The surface should be made very fine and the seed sowed from the first of July to the first of August. It is important that the crop should be grown quite rapidly. Also that no green stable-manure should be used. This manure will spoil the quality of the roots for table purposes and injure them for feeding to stock. Besides, they will be more likely to be eaten by worms than they will if fertilizers which are better adapted to their wants are used. Well-rotted manure will give good results if it is made very fine, but bone-flour, or superphosphate, will give a better quality of roots.

The sowing may be broadcast or in drills. We like the latter method much the best. From one to one and a half pounds of seed per acre should be used if put in drills, and from one to two pounds if it is scattered broadcast. If all the seeds should grow, and the plants do well, not more than from two to four ounces would be needed. But the seed costs but little and many plants are liable to be destroyed by the turnip fly or the scorching of the sun. Consequently, it is best to use a liberal quantity of seed. The fly attacks the plants when they are very small. By sprinkling lime-dust upon them early in the morning, while the dew is on, the fly may be kept off. The application will be needed only a few times.

If the seed is sowed broadcast, no cultivation can be given. If in drills, a hand-cultivator should be run between the rows, and a sharp hoe should be used to cut the weeds which are close to the plants, and also to loosen the soil. When the second leaf puts out, they should be thinned with a small hoe. The plants which are left should remain in clumps four or five inches apart. When they get straightened up after this operation, the surplus plants must be pulled by hand. Cultivation should be given at several times during the season, and should be finished before the leaves get very large.

The tops should be cut with a sharp hoe before the roots are pulled. If a little of the crown is clipped off, it will be no disadvantage. The roots may be pulled by hand or with a chain-harrow. The tops are worth something for feeding to stock.

Turnips may be preserved in trenches sixteen inches wide, two feet deep, and as long as the quantity to be stored requires. They should be placed only a foot deep in these trenches and then covered with the earth which was thrown out. If the weather becomes extremely cold, a quantity of stable-manure may be thrown upon the top. If only a small quantity of turnips is grown, the storing can be done in a cool, dark cellar. They can be put in bins or laid upon the ground. Only a few bushels should be put in a place, and a thin covering of earth will be beneficial.

For growing seed the best turnips should be selected in the fall and placed by themselves. The tops must not be cut very close. Early in the spring the roots should be put out, in good land, which has been plowed and harrowed. They should be set in rows three feet apart, and should be from fifteen to eighteen inches apart in the rows. A place should be made for the tap root, and the bulb should be covered with earth, but the sprouts must be left above the surface of the ground. The plants should be frequently hoed, and when the blossoms appear a small plow may be run between the rows, and the earth ridged up around the stalks in order to give them needed support. When many of the pods become dry, the heads should be cut and laid in some safe and convenient place. It is best to do the cutting when the dew is on. The pods will break open if handled when they are dry, and thus much of the seed will be wasted. The different varieties, and the turnips and ruta bagas, should be grown quite a distance apart. Otherwise the seed will be quite likely to mix and be spoiled.

The Ruta Baga, or "SWEDISH TURNIP," as it is often called, is generally classed in this country as a turnip, and may be grown

in nearly the same manner as the common sorts. The plants should be left from six to eight inches apart, if grown in drills and cultivated with a horse, or from twelve to fifteen inches, if grown in hills and hoed in the same way as corn. The latter way will give much the largest specimens, but they will not be of as good quality as the smaller ones which are grown by the other method. Some growers sow the seeds in a bed and put out the plants when they are of a suitable size. This makes more work than sowing in drills, but admits of more thorough cultivation. The ruta бага is larger and harder than the ordinary turnip, and will keep much later in the season. For early feeding it is not as good as the flat turnip, but it is greatly superior for use in the spring. Before being fed, the turnips, of any and all varieties, should be run through a root-cutter. They should be put in the mangers, in warm stables, and cattle should always be tied while eating them.

There are many varieties of the turnip. For feeding purposes the Early Flat Dutch is good, if wanted in the fall and early winter. The Amber Globe keeps during the winter and is first-rate. The Long White Cowhorn and the Pomeranean White Globe are both good for winter use. For feeding late in the winter and during the spring, and also for table use, the "Bloomsdale Ruta Baga" (obtained by a careful selection of the seed of the purple top ruta бага, and an improvement upon that variety) is decidedly the best which we have ever seen. This variety was introduced by the well-known PHILADELPHIA seedsmen, D. LANDRETH & SON, who have done more than any and all other parties to make turnip-growing popular in this country. The roots of this variety are well shaped, of good color, smooth skin, and have but very few leaves. The American ruta бага is also a popular sort. Of this there are two sub-varieties, the purple top and the green top. The former looks the best and is generally preferred.

DRAINING.

THIS consists in the removal of surplus water from the land. Various plans are adopted to secure the desired result. Each method has its advocates and each is open to some objection, either in respect to its efficiency, durability, or expense. The cheap methods are not first-rate, and the best ones are somewhat expensive.

Probably the majority of farmers who attempt to drain their land merely cut some ditches for carrying off the water. These answer a good purpose for a few years, but are liable to become filled with the mud which is washed from the soil, by the caving of the banks, and by the trampling of cattle through and over them. They are also objectionable in that they require a great deal of land. As a team cannot safely be driven close to them, quite a strip must be left upon each side of every one of these ditches without plowing. It is also necessary to provide bridges upon which they can be crossed when the teams are driven from one part of the field to another. In this way considerable expense is incurred, or else the owner will be put to a great deal of inconvenience by having but a few places where he can cross the ditches. For making these channels considerable time and labor are required. Yet, while they involve considerable direct expense and prevent the cultivation of part of the land, these ditches prove very useful in wet fields. The land which can be cultivated after they are made is rendered much more productive, and the labor of growing and securing crops is greatly decreased. In some fields the soil which is removed from these drains is valuable for mixing with manure and for use as bedding in the stables and hog pens. In such cases the value of the material will do much toward paying for the labor of securing it. But where the material which is thrown out cannot be utilized, this method of draining wet land will almost invariably pay well for all the time and labor required. Still, in many

cases it will not be the best way which can be devised for securing the benefits of draining.

A simpler method is to dig large, open ditches merely for the purpose of holding the water. This plan accomplishes some good as far as the draining of the land is concerned, but is open to the objections of keeping considerable quantities of stagnant water exposed to the air, of generating certain forms of disease, and of making the places in which they are located quite unhealthy.

The cultivation of land in ridges is another method by which a moderate degree of draining is practically effected. By plowing into narrow lands with wide, open furrows between, or by turning two furrows together from opposite directions and leaving a large, open space or water-furrow between each two ridges, and planting directly upon the top of each ridge, some of the advantages of draining can be secured. But in such cases they must be obtained at the expense of extra work in preparing the soil and cultivating the crop. They also require the use of a larger area of land than would otherwise be needed. It is not a very efficient method, and should only be used when land is very cheap or more thorough systems cannot be employed.

Parties in the East who are interested in the "driven well" (a well formed by driving down an iron pipe until it strikes a spring or reaches a wet strata in the soil) have proposed to drain wet fields by means of this invention. But the owners of the land are doubtful concerning the workings of the plan, and the managers of the patent do not seem inclined to warrant their work to be effectual. Consequently, no practical test, that we know of, has yet been made.

Another, and by far the best, method for removing the water from land is by underdraining. The drains are covered so that all the land can be cultivated, and teams can pass over them at any point. When properly laid, there is no caving of the banks and no filling of the channel with mud. They can be

laid so that they will last for generations, and the expense of putting them down will not be much greater than that of the makeshifts which are too frequently constructed. For this purpose various materials are employed. Some farmers fill the trench with brush. This should seldom be used. When an underdrain is made it should be made in a permanent manner. Turf is sometimes used for a covering of the top of drains. The sides of the trench are made very slanting, and a piece of turf is cut of such size and shape that it will go to within a few inches of the bottom, and there wedge against the sides strongly enough to allow the trench above to be filled without settling into the channel. This form is not at all to be commended.



FIG. 46.



FIG. 47.

Boards or planks are often used. If well laid, they will prove effective drains, and will last many years; but the material is of too perishable a nature, and should not be generally employed.

The two leading materials in use are stones and tiles. Of these, the former are often very abundant on farms which need draining, while the latter must be either bought or else manufactured on the place. Stone drains can be made so that they will be very durable, and answer all the requirements of first-class structures. But, in order to be good, they must be very carefully made. There are several different forms in use. The particular one to be laid in any special instance must depend upon the shape of the stones of which the drain is composed.

It is very desirable to have flat stones to lay upon the top and form the roof of the drain. These answer the double purpose of keeping out dirt and preventing the entrance of vermin. For the same reasons flat stones at the sides are of great value. Stone drains are very liable to become choked with sand and fine earth. The water passes through these drains very slowly, and there is not strength of current enough to wash obstructions along. Frost is more likely to interfere with stone than with tile drains, and there are various other reasons why tiles are very much the best. Men who have had practical experience with both kinds almost invariably prefer the tiles. MR. WARING declares that tiles are *much cheaper* than stones, and likely to be much more durable. He has shown, and many others have done the same, that when there is an abundance of stones on the farm, the owner will almost always find it for his interest to use tiles. The amount of time and labor required to get the stones together and select them for use is very great. The cost of digging the trench for stone drains is greatly in excess of that of making one for tiles. This because it must be very much larger, and it is also much slower filling with stones than it is to lay the tiles. But if the reverse were true, and it could be proved that the first cost of tile drains would be considerable more than that of those made of stones, we should strongly favor tiles on the ground of their permanence. Still, a farmer may be so situated as to make it necessary for him to have stone drains if he has any. In these cases the stones should be used as the best material which is available. But as a general rule tiles will be both cheaper and better.

Figure 46 represents a common form of stone drain. A much better one is shown in Figure 47. Figures 48 and 49 show the best form of tiles for ordinary drains. They are made of many different sizes. Figure 50 represents the "Y" form of the sole tile. This is to be used when two drains come together at an angle, and is a great improvement on the ordinary

style which must be fitted as it is used. The common tiles can be fitted, but with the tools which the farmer usually has the operation is a somewhat difficult one to perform. The "Y" and every other desirable form is made by the Moorhead Clay Works, of Philadelphia. This Company received the Centennial award for tiles and all other articles made of clay or its compounds.

Upon the principle of expediency merely, there are some farmers who can make use of the MOLE-PLOW for underdraining with manifest advantage. This implement is not at all adapted to general use, as it will only do good work in strong clay soils, and in some of these it is not very successful. For a man who



FIG. 48.—ROUND-TILE AND COLLAR.



FIG. 49.



FIG. 50.—SOLE "Y" TILES.

can do no better this plow will be a useful implement, but it should not be used with a view of obtaining permanent results. Where it works well, the drains keep open a few years and remove the surplus water from the land. But they are very liable to cave in from the top and sides, and thus become useless. In some parts of OHIO these drains have been quite successful, and they have been used with varying results in ENGLAND and in different clay soils in this country. For a poor man to use as a makeshift until he can obtain something of greater permanence they may be recommended, but they should never be used when tiles can be afforded.

There is a great deal more land in this country which needs draining than many people suppose. Not only the extremely

wet, swampy fields, but many tracts which are only occasionally too wet would be greatly improved by a thorough system of drainage. Fields containing many springs, sandy or other porous soils with clay, or other hard and impervious sub-soil, and all clay soils may be said to need thorough draining. That swamps, and land full of springs, need draining is too evident to require an argument to support the assertion. Soils which are only occasionally too wet need draining in order to insure the regular production of good crops. In dry seasons they may do well, but in wet years the yield is usually very light and the quality is inferior. It often happens that the heaviest rain-fall comes at a time when the farmer is in a hurry to work the land, and that great loss is occasioned by the delay which is thus necessitated. Planting is often delayed ten days, or longer, by this cause, and the crop much diminished in consequence. Sometimes the rain comes just as the farmer wants to cultivate his crop. Then the work must be put off, haying soon comes on, and the crop suffers greatly from neglect. These heavy rains also keep the soil very cold—a condition highly unfavorable to the growth of plants.

The average rain-fall in the UNITED STATES is about three inches per month. In some States (and some which have a very compact and retentive soil) it averages about three and one-third inches. A large proportion of this immense amount of water must leave the soil either by drainage or evaporation. In order to be in a good condition for crops, the land must be moist but not wet. Therefore there is a great deal of water to dispose of. If the soil is retentive and the land is level, almost all of this water must be evaporated. If the soil is porous, but the sub-soil is impervious, a large part of the work of removal must be done in the same manner. Let us consider for a moment what the removal of this water by evaporation involves.

Evaporation consists in the conversion of water into vapor. From undrained land the water must be removed, in this way,

by the heat of the sun. To convert water into vapor requires about four times as much heat as is needed to bring it to the boiling point from a temperature only just above the freezing point. An inch of rain, equal to three hundred and sixty hogsheads of water, frequently falls upon an acre of land in a single shower. If this land is not drained, there must be heat enough from the sun to bring nearly fifteen hundred hogsheads of water from a freezing to a boiling point, in order to remove the surplus water furnished by this one shower. Take the average autumn and spring rains at ten inches each, and the winter rains and snows at eight inches, and consider the immense amount of heat required to fit an undrained soil for planting. But a small proportion of the autumn rains can be evaporated when they fall, because the weather is so cold. The same is true of the rains and snows of winter. Therefore in the spring this vast accumulation of moisture must be removed. Instead of warming the land, as it would if the soil were reasonably dry, the heat of the sun must be used for evaporating the water, and the undrained fields will be cold and wet long after those which are drained are warm and dry.

Thus draining the land enables the farmer to do his planting early in the season, and cultivate his crops at the proper time. It also makes the land so much warmer that the autumn frosts will be delayed, and more time will be given for the corn to ripen, the rowen to grow, and other crops to mature. Draining also acts as a powerful agent in preventing injury to crops in time of drought. A well-drained soil is not only drier in a wet time, but contains more moisture than an undrained one when the rain-fall is insufficient. The draining loosens and deepens the soil, and allows it to condense and absorb a much larger quantity of moisture from the air and dews than an undrained soil. The roots of plants are also able to penetrate to a much greater depth, go nearer the point of constant moisture, and present a much larger surface to the action of the

earth and air. It has often been noticed that land which has been deeply plowed withstands the drought much better than the same kind of soil which has been cultivated shallow. What deep plowing does in this respect can be accomplished by thorough underdraining. When they go together the very best results are obtained, and by their aid injury from any ordinary drought may be wholly prevented. During a severe drought in NEW JERSEY, in 1855, the fences on the land of PROF. MAPES were found to be the boundaries of its influence. The land all around this farm was parched, and the crops were being spoiled, while the land inside the fences was unaffected, and the crops were in splendid condition. This was not caused by any difference in the natural character of the soils, but by the thorough drainage and deep culture of the farm belonging to PROF. MAPES.

Draining makes a damp location much more healthful for men and animals, as well as for crops. It prevents the accumulation of surface water, which soon stagnates and becomes a prolific source of disease. Drainage of wet districts in cities has greatly reduced the annual death-rate, and decreased the amount of sickness which is not fatal. In the country attacks of malarial diseases are much more frequent and severe in wet locations than they are in dry ones. Veterinarians have called the attention of farmers to the fact that many diseases of sheep and cattle are either directly caused or greatly aggravated by wet pastures. This fact furnishes a strong argument in favor of draining pastures, although the increase in quantity, and improvement in quality of the grass which it will produce, would seem to be a sufficient inducement for the owners of the stock to undertake the work. We have already alluded to the fact that our cultivated plants will not make a healthy growth in standing water. If much water stands upon the surface of the land the plants will die. If there are a few inches of stagnant water under the surface, resting upon an impervious

subsoil, the roots will go to this water-line and stop. The plants will present a yellow and sickly appearance, and will yield either a light harvest or none at all. But if the land is drained, the plants will make a strong and vigorous growth, the soil will be so open that the rains will carry down the soluble elements of plant-food to the roots, leaving the land moist without flooding it, and the crops will be comparatively free from the diseases which are likely to attack plants which grow in wet localities.

Draining also prevents the winter-killing which often proves so injurious to wheat and rye. When the subsoil is impervious, the autumn rains make the surface soil very wet. In the winter the water in this soil freezes and thaws, causing the land to "heave," and breaking and uncovering the roots of the grain. If this process is often repeated it proves very destructive. Many a field of wheat which looked finely in the fall has been utterly ruined by this cause. If the water is not allowed to accumulate, as it will not be on well-drained land, there will be but very little trouble from this source. The grain will not only look nicely in the fall, but will go through the winter without injury, and be ready to grow rapidly in the spring. Since draining has become general in ENGLAND, the average wheat yield has more than doubled. This increase has not been so much in the direction of excessively large crops, as it has in the line of making it more certain that a crop shall be produced. Failures, which before were quite common, are now very rare, and almost all the land devoted to the production of this crop adds something to the amount of grain which is actually grown. If every acre devoted to wheat in this country could be made to produce merely a medium yield, the total amount grown would be immensely increased. For there are now thousands of acres which produce only a very little, which count in the report of acres, but produce so few bushels of wheat as to make scarcely an addition to the figures representing the quantity grown.

In this way the average production is brought very low. Thorough draining would make most of these fields productive, and thus largely increase the yield of grain, and the profits of growing it.

Another effect of thorough draining is to greatly increase the efficacy of the fertilizers which are applied to the land. This end is accomplished in various ways. The drained soil absorbs the fertilizing elements which the water contains or which may have been washed from manures. But in the undrained soil much of this fertilizing material is lost. Water flows from the land, and, being so completely saturated, the soil cannot absorb anything from it. It is supposed that plants receive their food in a state of solution—dissolved in water. If this is the case it is easy to see why an excess of moisture is detrimental to crops. Their food is so diluted that they can obtain but a very little. A plant can take only a certain quantity. If the food which should be dissolved in a pint of water is spread through a quart, twice the time which ought to be sufficient will be required for the plant to obtain its supply. A calf that was obliged to drink a barrel of water to obtain a pail of milk which had been stirred therein would grow very slowly. Every one knows better than to feed a calf in this way. But when the farmer attempts to grow his crops in a wet, undrained soil, he tries to feed his plants upon the same principle. It is plain that no great success can attend such efforts.

In very dry seasons, manures which are used upon undrained lands are not as efficient as they are upon drained soils of the same nature. This is due to the fact that the former are very compact and do not allow the small quantity of rain which falls to pass freely through them, while the latter are mellow and porous and allow the rain to wash down the elements of fertility to the roots of the plants. In a wet season, manures applied to wet land do not prove of much benefit because the presence of an excess of water prevents the decomposition without which

manure cannot be made available for the use of crops. The fact that there is much less waste of fertilizing elements from a well-drained soil than from one which is full of water also accounts for the increased permanence in the effect of manures which has so often been observed.

The cost of draining will vary greatly with the character of the soil, the kind of drains, the depth at which they are placed, the cost of labor, expense of materials, and various other items which in different sections command different prices. We have already indicated our preference for tile drains. We consider them altogether the best, and believe that in those sections where land is valuable most farmers who can afford to drain their land at all can afford to use tiles, and that, when permanence and efficiency are considered, they will find tiles much cheaper than either stone or wood. But where land is too cheap, or the owner cannot afford tiles, let him use the best material which he can secure. Even brush drains are a great deal better than none. The same may be said of turf drains and open ditches. Because a farmer cannot have the best is no reason why he should do without drains. If he cannot afford tiles, let him commence draining in an inexpensive manner, and the profits of his business may soon increase so that he can use better materials.

The subject is one in which farmers throughout the country are deeply interested. To those of the SOUTH it may be said to have a special importance. PROF. PENDLETON has called attention to the fact that much of the hilly land in some of the best farming sections has become impoverished by a bad system of culture, and by continual washings away of the soil and manure which have been swept into the valleys which are now too wet to be serviceable. He says that many valuable bottoms have been lost to cultivation, and malarial fevers have become much more prevalent than they formerly were. These lands, if well under-drained, would become the most profitable of any in the SOUTH.

“The uplands need an annual outlay of money for manures, more than the ditching would cost.” When once done as it should be, the underdraining will last an age, and the land will long be productive without requiring an excessive outlay for fertilizers. Here seems to be an opportunity to make a permanent improvement and still save money by the operation. If part of the money now paid for fertilizers to be used on the uplands were to be invested in draining the lowlands, which are already rich, they would immediately become more productive than the other fields, larger crops would be obtained at a reduced cost, and the cash value of the farms would be greatly increased.

Unlike some permanent improvements draining makes an immediate return. Upon heavy clay soils the best effects will not be observed until the second year, but much benefit will be obtained the first season. When once thoroughly done, if the land is valuable, draining pays a large percentage upon the cost of its performance. This work is not done merely for the present, but also for the future. It makes returns immediately and will continue to make them every season for an indefinite time. In many cases the draining of his wet land will be one of the safest and best paying improvements which the owner can make on his farm.

THE WATER SUPPLY.

BOTH the comfort and the health of the farmer and his family, and the thrift of his domestic animals, will depend, in no small degree, upon the quantity and quality of the water which is furnished on the farm. To be without an adequate supply of water, even for a short time, at any season of the year, causes a great deal of suffering and involves losses and injuries of various kinds. When the quantity is abundant but the quality is poor, the evil is greatly

increased. The danger is constant, and though the results of exposure are not always at once apparent, they are pretty certain to become manifested sooner or later and to bring a great deal of suffering in their train. For while it is impossible to live without water, and very unpleasant to be obliged to get along with an insufficient quantity, it is absolutely dangerous to use water which is very impure. Too many farmers regard the water supply as merely a convenience. They are glad if they have good water, and sorry if they have poor, but they do not appreciate the one nor realize the danger involved in the use of the other. Probably nine out of ten farmers who have only a poor quality of water on their farms regard it as merely an inconvenience, and think of a supply of good water as they do of a silver-plated harness—a good thing to have, but one which the average farmer can get along well enough without. The idea that it would *pay*, not merely in convenience and comfort, but in dollars and cents, to make an effort to obtain good water, has never entered their minds. They will probably be inclined to doubt our assertion that it will pay—an assertion which we do not hesitate to make—until they have given the matter a little careful thought. Then they will be thoroughly convinced that it is just as important to invest money, if need be, to secure good water, as it is to be at great expense to obtain houses and barns.

The sources of supply of water for the farm are but few in number, and upon most farms but one or two are in practical operation. A very few farms are so situated as to have running water at the house and barn, or at either one of these buildings. When this water flows from a good spring, through a good conductor, and care is taken to divert the waste from the buildings, all the advantages of a water supply may be secured and its dangers can be almost wholly avoided. When the spring is impure, the water must be bad. When it is taken from a small, stagnant, dirty frog-pond, the water becomes an element of

danger. Water flowing through a lead pipe, even though the water at the spring may be first-rate, often brings poison into the house and undermines the health of the inmates. This is especially true of water which acts strongly upon lead, and of those cases in which the water runs quite a distance and with considerable rapidity. Not only are the inmates of the farmhouse poisoned by water which has become impregnated with lead by flowing through a pipe of that material, but the cattle often sustain severe injury from the same cause. Many cases have been observed in which cattle failed to do well, and the cause was traced to the use of water passing through lead pipe. That water flowing through lead pipes is dangerous to the health of both man and beast there is an abundance of medical and chemical evidence which we have not space to present, but which ought to be sufficient to prevent the use of this material for conveying water which is to be used for drinking purposes. Careful observation of the health of families and animals using water which flows in lead pipes should be a means of inducing others to let such water alone. The slow but certain accumulation of poison in the system must work the greatest injury to the health.

We should never favor the use of lead for conducting water which is to be drank by man or beast. Wood is not as convenient or as durable, but is usually cheaper than lead, and has the immense advantage of being safe. Iron is often used, and generally gives satisfaction. Other materials are sometimes employed. But for ordinary farm-use we prefer wooden pipes, made of good material, and carefully laid.

The advantages of good running water to the house and barn are much greater than are generally supposed—but water should never be taken from a poor spring to be used about the buildings. The farmer who has a never-failing spring of good water conveniently located has a treasure which is worth far more than it is usually estimated by owners or their neighbors. Such a

spring should be utilized, and, if possible, the water should be made to flow to both house and barn. If the spring is situated higher than the buildings, this can easily be done, for the water will be ready enough to flow down hill. If the buildings are on higher land than the spring, the water can be forced up by a hydraulic ram. This, unless the distance is great, will not involve a very great expense. The water may first flow to a tank, or reservoir, in the house from which the waste-pipe leads directly to a tank at the barn. If the barn is on higher land than the house, the water can come part way from the spring in one pipe; but at some point higher than the tank at either building another should be added, so that there will be a separate pipe at each tank. If the supply of water is small, a reservoir may be needed at this point; but if there is plenty of water, this will not be necessary.

Wherever water is taken from a spring, a great deal of care should be used to keep it as clean and pure as possible. A fine grate should be placed over the end of the pipe, the water should flow into a small box or tank close by, from which the pipes to the building should proceed, and a strong, tight fence should be built around the spring to keep cattle and other animals from getting to it. The spring should be frequently examined, and constantly kept in a wholesome condition. When there is no spring of this description upon the farm, but there is one near by which can be bought for a reasonable price, it may be wise to make the purchase. It will certainly pay if the home supply of water is of poor quality or deficient in quantity. In buying such property care should be taken to secure a perfect title, and a good lawyer should be employed to write the deed. This course may save a vast amount of trouble, and some bitter quarrels in the future. As the advantages of having good, pure, running water constantly at the house and barn are very great, the man who is buying a spring which will answer all his requirements should be willing to pay a fair price

for its possession. The farmer who has such a spring on his own land is very fortunate. He has one of the finest sources of supply in all the world, and ought to use and be thankful for the same.

Another source of supply—one upon which but comparatively few farmers depend—is the rain-water which falls upon the roofs of their buildings, and is collected in a cistern for use as it may be required. When properly filtered this water is pure enough for all practical purposes, but it is not usually as pleasant for drinking as good spring water. Being “soft” it is excellent for washing and for various household purposes—very much better than “hard” water from wells or springs. With this water the labor of washing is very much reduced, and not nearly as much soap is required as is needed when “hard” water is used. On this account, and also because it is much better than it is to have the water running into the cellar or around the buildings, it is well for farmers who do not have from other sources good water for washing, to provide cisterns in which the rain-water can be preserved until it is wanted for use. Such a cistern may be made of brick, of any size or shape desired, and should be cemented on the bottom and sides. The bottom can be covered with, and the walls made of, small stones, but we should much prefer to use brick. A circular form seems to us the most desirable. The size which will be needed will depend upon the amount of surface of the roof upon which the rain is to fall, and upon the regularity with which the water is used. If a cistern is used merely to supply water when the wells have failed from drought, it must be much larger than will be wanted for common use. If it is only used to furnish water for washing-days, it will not be necessary to have as large a one as would be wanted if it were to hold water for all household purposes and also a supply for the cattle.

For each ten inches in depth a circular cistern five and one-half feet in diameter will hold a little more than one hundred

and forty-eight and one-half gallons. MR. WARING gives the average amount of rain in the NORTHERN States at about three feet per year, equal to three inches per month, and says that "every inch in depth that falls upon a roof yields two barrels for each ten feet square, and seventy-two barrels a year are yielded by three feet of rain." With this rain-fall a barn thirty by forty feet will supply an average of more than two barrels of water per day during the entire year. MR. WARING gives the size of a circular cistern adapted to such a roof as the above as thirteen feet in diameter and eight and one-third feet deep, provided it is used to furnish a daily supply of water. This would hold what water would fall in the two wettest months of any ordinary year. When the cistern is designed to hold water to be used in time of drought, it should be made to contain about three times as much as one of the size given above. It seems to us that this size is much larger than will be needed by any ordinary family—certainly larger than will be wanted if the family use considerable well, or spring, water—but the cost of making one of the above dimensions will not be very much greater than that of one holding only half as much, and it is better to have one larger than is needed than it is not to have it large enough. When the water from the cistern is to be used for cooking and drinking it should be filtered. It is better for any purpose to have it purified in this manner. A very simple and very perfect filter is thus described by MR. WARING: "Divide the cistern into two equal compartments by a wall of brick or stone, open at the bottom to the height of about six inches, and water-tight thence to the top. Let one compartment be for receiving the water, and the other for containing it when filtered and ready for use. Put alternate layers, six inches deep, of gravel, sand, and pounded charcoal at the bottom of the former, and sand and gravel at the bottom of the latter. The former will receive the water from the pipe, and it will rise filtered in the latter." The pipe from the roof should enter one

of these compartments and the pipe from the pump the other. The cistern should be arched over with brick, and a solid, closely-fitting trap-door should be provided at the top large enough to allow a man to enter when it is necessary to clean the interior. This door should be kept *closed*. An uncovered cistern is an abominable nuisance, dangerous to man and beast, and a perfect death-trap for children. If something cheaper than the cistern described above is wanted, a square one can be dug, walled, and cemented, and a flat plank cover closely fitted over the top. A really good one need not be very expensive and will more than pay for its cost every season. If a cheap one is well made it will prove very useful and give good satisfaction. We hope these strength and labor-saving conveniences will become much more common than they have been as yet in all the "hard" water districts of the country.

Another, and the principal source of supply, is to be found in the ordinary well. By far the larger part of the farmers in this country are unable to obtain running water, very many are unable and many more make no effort to save the rain-water which falls so abundantly, and so it comes to pass that nearly all rely upon wells for supplying water. These, if properly made and fed by living springs, answer the purpose for which they were designed. But when badly made, or when the springs are intermittent, they often fail. They fail, too, at just those times when they are most needed. When there is water enough everywhere else these wells yield an abundant supply. But let a dry time come, so that the wells are really needed, and they will very soon fail. It is a very common fault with wells that they are not sunk deep enough. It is considerable work to dig a well, and the farmer does not want to do any more of it than is necessary. For this he cannot be blamed, but he should remember that while digging a well is the time in which all the work should be done. It is not nearly as expensive going to a great depth then as it is after the well has been tried and found

too shallow. We have known some cases in which wells have been lowered after having been in use for years. It is better to sink them deeper if they fail in dry seasons than to try to get along with them as they are, but it is far the best way to make them right at first. A very dry time should be selected in which to dig a well. When the ground is full of water the labor of digging is greatly increased, and there is but little hope of securing a good well. If weak springs are struck they should be disregarded and the well sunk to where a strong and constant flow of water can be obtained. Another very common fault with wells is that they are made too small. It is less work to dig a small well than it is a large one, but it is not nearly as good after it is dug. A small well is difficult to clean when it needs such an operation, and it will not hold nearly as much water as a large one. Very few farmers are aware of the difference in the capacity of large and small wells. A well three and a half feet in diameter will hold fifty-nine and nine hundred and eighty one-thousandths gallons of water for every ten inches in depth, while a well six feet in diameter will hold one hundred and seventy-six and two hundred and fifty-three one-thousandths gallons for the same depth. Most wells fill up considerably in spring and fall, but by constant use the water is gradually withdrawn until it gets very low, or is entirely exhausted. If the wells were larger they would hold enough to furnish a constant supply. Besides, it is very much easier drawing the water when it is near the top than it is to get it from a depth of twenty or thirty feet. Large wells, sunk deep enough to gain one or more strong and living springs, are very desirable, and should be found on every farm which is not amply provided with water from one or both of the other sources which have been considered. As a general rule, there should be one well for the house and another for the barn. A well should *never* be located in, or close to, a cellar, nor in a low spot of ground which receives the drainage from the surface of the surrounding land.

No sink drain, or any other drain, should be allowed to pass near a well, and closets and vaults should be placed at such a distance as to make it utterly impossible for the wells to be affected by their drainage. These vaults *should* be cemented, but many of them are not, and their contents soak into the surrounding soil. Upon some farms the well at which water for the house is obtained is situated on much lower land than the barn-yard. The latter is often very wet, and water runs from it into the well. Such cases are altogether too common. Sometimes the well and cellar are connected by a system of natural drainage.

One of our neighbors who had an undrained cellar and a well, from which the drinking water was obtained, close by, found that in a wet time the water would flow from the well into the cellar, and when by constant use the quantity in the well was diminished so that it reached a lower point than the bottom of the cellar, there would be a current from the cellar into the well. There are many other ways in which the water in farm-wells becomes contaminated. Organic matter in large quantities is washed into the wells, and slowly decays. By the presence of this matter the water is poisoned, and becomes a source of disease to those who use it. Poisonous matters are carried in this way a much greater distance than people generally suppose. And the poison may be so subtle that the water looks and tastes as well as ever, although it holds in solution elements which are dangerous to the health of those who drink it. The greatest care should be taken to keep the water, both for the house and barn, perfectly pure. The water in wells is sometimes contaminated by having a lead pipe constantly in the water, the pump in the house, and the top of the well closely covered from the air. In this way there is no method by which the air in the well can be changed, or the water stirred. We have already alluded to the bad effects resulting from the use of lead pipes to conduct water from springs. When the pipe is placed in

standing water, and is kept constantly full, the danger from poison must be very great. We would never allow a lead pipe in a well from which we used the water. Wood or iron is much to be preferred. When the pump is in the kitchen, as it always should be, wooden pipes, though not as convenient, can be used without a great deal of trouble or expense. The old-fashioned bucket and sweep is a slow and hard method of drawing water.

The common suction-pump is easier and better. The "chain" pump has the great advantage of stirring the water and ventilating the well, but it wears out too soon. An improvement, consisting of the use of rubber instead of metal buckets on an endless chain, has lately been patented. We have seen only one of these pumps in operation. It worked well, and we see no reason why it will not be durable, and answer all the purposes for which a pump on the farm is desired. Wells should *never* be left uncovered unless high and strong curbs are erected around them. Even when there is no pump it is better that there should be a curb than to have the well covered with planks. The latter will decay, and may break under the weight of a man, or even a child. Animals are also in danger of falling into these neglected wells. Heavy, flat stones are better than planks, but a good curb is to be preferred.

The only remaining source of supply which is in anything like common use, and the use of which, though not general, is altogether too common, is found in ponds and brooks which are located upon, or flow through the farms to which they furnish water. As an almost invariable rule the former are among the most miserable of all sources from which water is obtained. The ordinary pond is full of water in a wet time, and nearly dry in a time of drought. This water is heavily loaded with organic matter, and in hot weather, when a large proportion of what the pond has contained has been evaporated and what is left is strongly concentrated, it is fit for neither man nor beast.

The pond which the poet describes, full of clear water, with grassy bank, and clean, pebbly bed, is not the kind of pond which is usually found on the farm. The genuine pond is a dirty, muddy hole, partly full of stagnant water, which is chiefly useful in furnishing a breeding-place for mosquitoes and a home for frogs. The brooks furnish a far better quality of water than ponds, but they are usually so located as to be practically unavailable. Besides, as the water is liable to be contaminated in various ways, this source is not sufficiently pure to render it safe for family use. It ought to be too far away to admit of profitable use, even if it were desired, for no house should be built in the immediate vicinity of a brook. The habit of turning cattle into the fields in winter to get water from the brooks has involved loss enough to the farmers who have practised it for any length of time to have enabled them to have dug splendid wells, and furnished them with the best pumps in the market. When cattle are driven out in this way they will not drink as often as they ought to; they will drink too much at a time, and be badly chilled in consequence; they will be liable to accidents from slipping on the ice or down the banks; their health will be injured, they will not thrive, and there will be a great and inevitable waste of manure. No farmer, however poor, can afford to follow such a wasteful practice. He had better dig a well or else give up keeping stock. A clean and never-failing brook in a summer pasture will do nicely, but even this is not suitable for family use or for a winter supply for cattle. And these clean brooks are not very common. Consequently but comparatively few farmers can have the advantages of them even in summer. The majority should rely upon wells. These should be provided in pastures, as a constant supply of pure water cannot be otherwise obtained. Where much stock is kept, a wind-mill, with an automatic arrangement for regulating the quantity of water to be pumped at any given time, should be provided.

In small pastures which are near the house the pumping may be done by hand. In some localities the "driven well," which is now being introduced in various parts of the country, may be used to good advantage. It will furnish a plentiful supply of water and its cost is very small. But it is not wise to place too much dependence upon wells of this kind. They often prove entire failures. Several have been put down in this neighborhood. So far as we know, not one of them is strictly first-class, while most of them are useless. In some places they do better, and where they do succeed they furnish water at a low cost. But in arranging for one of these wells the farmer should insist upon having a good supply of water, or else having the well free of expense. In this vicinity the agents are ready to take the risk. They ought to everywhere. For the farmer can hire a well dug which will be sure to furnish water. If he is to pay anything for a driven well he should have the same certainty. We think these wells are better adapted for use in pastures during the warm weather than they are for constant use at a house or barn.

This subject of a water supply on the farm is one of very great importance. It has a direct bearing upon the health and happiness of man and beast, and exerts a powerful influence upon the financial standing of the farmer. If any of our readers think we have dwelt too much upon the convenience of having a supply of good water, and have not paid enough attention to the profit which it will add to the business of the farmer, let them remember that in the convenience and comfort of which we have spoken a high degree of financial success is comprehended. But it may be well to put the matter a little more strongly in the light of dollars and cents. Take a couple of illustrations. On one farm there is one good well at a house, another at the barn, and a clear brook, or else a good well in the summer pastures. The inmates of the house enjoy good health, the cattle are thrifty, and the farming pays. On another

farm the sink-drain passes near the well from which water is taken for household purposes, the barn-yard and the vault are on higher land and are altogether too near this well, the well at the barn is an uncertain source of supply, is dry part of the time, and receives part of the leachings of the yard when it is wet, while in the pasture the cattle are obliged to get water from a stagnant pond. The farmer and his family are afflicted with various forms of disease which obstinately resist medical treatment, though they involve a great expense for doctor's visits and medicines. The cattle which are kept here do not thrive, the young stock is poor and grows very slowly, cows lose their calves, milk taints easily, the butter made from it is poor, much of the manure is wasted while the cattle are running around after water, and so the land grows poor, the crops are light, and the farming does not prove a paying business. Such are some of the items of difference caused by a good or a poor supply of water on the farm. In the light of these, and of similar things which might be mentioned if time and space would permit, every farmer must see that his financial interests are at stake, and that it will make a great difference with the results of his work whether he has plenty of pure water on his farm or attempts to get along with water which it is neither safe nor pleasant for men or animals to use. The cost of furnishing good water on a farm will be very soon saved in cash, and the comfort which it brings will be free from all expense.

HOME PRODUCTION.

N home production we have one of the foundation principles of successful farming. By accepting its guidance many a man who was not only ignorant of science in its application to agriculture, but who also worked at an immense disadvantage on account of his want of

skill in managing his affairs, has been enabled to win a very fair degree of success, while many other men, of good education and superior ability, have neglected this point while attending to many others and have not been able to succeed.

There are theories which have been very nicely elaborated and which prove, as far as theories can, that an enlightened and strictly first-class style of farming demands the cultivation of only a few kinds of crops by the individual farmer. We have been very often told that scientific farming requires a man to find what crops his land is the best fitted to produce, and then devote himself with all possible zeal to the growth of those particular products. A great many farmers have been carried away with the idea, and are now growing their "specialties" with very indifferent success. The theory which looked so plausible on paper does not give as good practical results as were both expected and desired. There are certain places where it works very well, and if there were a good market for everything at every man's door there would be no difficulty in its general acceptance. But such markets do not exist and cannot be made. We are obliged to take things as they are, without regard to what they ought to be, or to what they might be under different circumstances. Wisdom requires us to deal with facts to a much greater extent than we do with theories. Of all the facts which have a direct bearing upon the business of the farmer, few are more clearly set forth by the experience of the past than that, as a rule applicable to all sections, home production of articles needed for home consumption is the surest way in which to win success. Where one man has succeeded in the cultivation of special crops, probably ten men have been successful in following a course of mixed husbandry. The latter run much less risk and average much higher profits than the former. In times of general business depression the man who produces a large proportion of his own household necessities has an immense advantage over his neighbor who grows but a few crops and is

obliged to buy nearly everything which is used in his family. At such times the difference between the results obtained by these methods appears greater than it does when all kinds of business are good, but at all times the man who is obliged to buy but little, even though he has but little to sell, is the one who is on the direct road to success.

This principle of home production is the only one upon which farmers can act with the assurance of becoming really independent. We read and hear a great deal about the privations of the pioneer settlers, and there is no doubt that they are obliged to give up many things which would make them more comfortable and happy. At the same time there is abundant proof that these settlers, who have to fight their way with nature, who have but few tools and but little to do with though they have many obstacles to overcome, are very likely to succeed in securing homes and obtaining property. There is no secret in the way in which they secure their desired ends. They work hard, it is true, but this can also be said of most of the farmers in the older settled portions of the country. They are economical, and so are a multitude of farmers who do not get along in the world. The main difference between the pioneer and the man who has always lived in a thickly settled region is to be found in the fact that the former grows upon his own land almost everything which himself or his family consumes, while the latter is constantly buying of others things which he needs, and which he ought to, but does not, grow for himself. It is true that the man living in a community is obliged to incur some expenses which the pioneer does not have to meet. He cannot, and he ought not to try to live just as the pioneer does. With the progress of civilization the expenses of living will, for a while, increase. But with these extra expenses come many compensations of both a moral and a pecuniary nature, and every one should rejoice in the progress which has been made. Viewed in a moral light it is of immense importance, both to the individual and the

community, that the benefits of churches, and schools, and post-offices, should be extended to all the people in our land.

From a pecuniary standpoint we find that though the necessary expenses of living are somewhat increased, the opportunities for accumulation are also enlarged, and that the same principles which were followed in the wilderness will lead to, at least, an equal degree of success on the farm in the vicinity of a village or town. The farmer who lives in a civilized community needs money for more purposes than the pioneer, but as he has many more ways of obtaining it, this can hardly be considered a disadvantage. He will be obliged to modify the details somewhat, but the same general principles should be allowed to govern his course. If it is objected that the difference in circumstances and surroundings between the pioneer and the farmer in a thickly settled community is so great that no legitimate comparison can be instituted, we not only reply that the objection does not seem to be well founded, but also that plenty of examples can be found in the older communities which prove, beyond all chance of cavil or doubt, that home production is the key to success on the farm.

If he will only look around him, probably every farmer will find examples of the success which has been secured by adopting this principle. There are men in almost every hamlet who have year after year been striving to supply their wants from their own farms. They are, as a general rule, very quiet men. They do not attend conventions and their voices are not heard in public meetings in which the problems of the farm are discussed. Their silence has been the means of causing their work to remain almost unnoticed. They do not carry on an immense business. Other men seem to be doing a great deal more than they. But when it comes to the profit, which is the end in view, they are far in advance of their more prominent neighbors. There are no mortgages upon their farms and they have no large outstanding bills. They are not obliged to buy

largely on the credit of a crop yet to be grown, and they are never left at the mercy of dealers in a certain kind of grain or compelled to risk everything upon the success or failure of a single crop.

We are well aware that those who are opposed to this view present some very plausible arguments against it, but we also know how the two theories work in practical experience, and we are strongly inclined to favor that which gives good results in practice in preference to a plan which is ably supported by arguments but which breaks down under a practical test. During the past fifteen years we have seen the workings of the specialty system on an extensive scale. We expected a partial failure, but the results were far more disastrous than we anticipated. In one of the finest farming sections of this broad land the specialty system, in connection with evils which naturally follow in its course, has brought hundreds of men, who under the old system of culture were doing well, into circumstances of financial embarrassment, while many have been sold out of house and home by the sheriff.

Twenty years ago the farmers in the Connecticut Valley were doing a small but a reasonably profitable business. They cultivated a variety of crops, produced on their own farms a large part of their household necessities, and had no debts which they could not pay. But in an evil hour some venturesome spirits found that tobacco would pay a large profit. The price advanced rapidly, the demand increased, and a multitude of farmers who had been in the habit of growing corn, potatoes and hay, turned their attention to the culture of this crop. Like the tulip mania which in olden time well-nigh ruined the staid old inhabitants of HOLLAND, this tobacco mania seemed to fairly possess the souls of men who had been regarded as wise counsellors and worthy examples. Young men thought they saw the way to fortune very clearly marked out, and bought land for the culture and put up buildings for the curing of tobacco, going into debt for

both land and buildings with a recklessness almost sublime. Land rapidly advanced in price. In some sections land which was barely worth one hundred dollars was sold for five hundred dollars per acre. Men seemed to think that by making a specialty of tobacco they could afford to pay almost any price for land.

Not only did they buy land at fearfully inflated prices, but they bought almost everything else. They had but little money, and soon were deeply in debt; but by growing tobacco they expected to make money enough to pay for everything which they wanted to buy. Those were golden days for dealers in sewing machines, parlor organs and pianos. Sales could be easily effected at prices which were highly satisfactory to the agents and their employers.

The idea also became firmly fixed in a great many minds that the tobacco-grower could buy all the ordinary farm-products cheaper than he could grow them. Many a farmer, who in former times had made money in growing corn for half what was then its selling price, was convinced that it would not pay him to grow corn, for he could buy it for less than the actual cost of cultivation. The same reasoning was applied to almost all of the other old-fashioned crops. As the inevitable result of such a course, farmers not only had nothing but tobacco to sell, but, far worse than this, they were constantly obliged to buy things which they had formerly grown at home. After a few years, the farms began to show an unmistakable decline. The few acres which had been devoted to tobacco, and to which large quantities of fertilizers had been applied, were in fine condition, but all the rest of the farm had been robbed in order to make the tobacco fields rich enough to produce a good crop.

Still farmers seemed to have implicit faith in the future of tobacco, and though their debts remained unpaid, and their bills at the village store were daily increasing in amount, they were not alarmed. Once a year they sold their tobacco. For a few

days they had considerable money. But when the store bills were settled, and the interest on their borrowed money was paid, they were, in a financial point of view, pretty well reduced. In a short time the old credit system was again adopted. They bought freely, promising to pay when they sold their tobacco. Large quantities of fertilizers were bought to be paid for when the crop to which they were applied was ripe and sold. Sound business principles seemed to be forgotten by buyer and seller alike. All parties who were engaged in the business failed to see that tobacco-growing not only possessed all the weakness which is inherent in the one crop system, but certain elements of danger not necessarily connected with the growing of a specialty. But in time their eyes were opened. When it was too late their mistake became evident.

Tobacco proved to be a very uncertain crop. In good seasons, when the land was of a suitable nature and was well prepared, there was no great difficulty in securing a good yield. But some seasons were not favorable, and the crop did not do well. One summer an untimely hail-storm utterly destroyed the whole crop for many farmers who had made it their chief reliance for the support of their families for a year. Some seasons drought seriously injured it; at other times the tobacco-worm was terribly destructive; and when these evils were avoided or overcome, others seemed to be ready to carry on the ruinous work.

Then, too, when the growth of the crop was all that could be desired, the curing process was not always safely accomplished. In some cases, after the cost of growing and harvesting had been sustained, a defect in the curing almost ruined the product. After a while a time came when the demand for tobacco ceased. Unlike corn, or wheat, or many other crops which are sometimes grown as specialties, this product could not be consumed at home. For all practical purposes it was wholly worthless. Until it would sell it was good for nothing. Prices rapidly

went down, and the dream of the tobacco-grower came to an end. Many farmers found debts pressing heavily upon them with no means of payment. "Hard times" came on, and property depreciated rapidly in value until it came to a point where prices were merely nominal. Some of those who had done the largest business and been considered wealthy men went through bankruptcy, and paid but a few cents on a dollar. Others compromised with their creditors, while some sanguine men attempted to pull through. Like the growth of Jonah's gourd, the prosperity of this industry was sudden and brilliant; while like the decay of that vine, whose history will be immortal, its failure was sudden, unexpected and complete. It was a terrible revelation, but it came with all the force of solemn truth.

Perhaps some reader will be inclined to assert that all this loss and evil was due to the peculiar times and the extraordinary circumstances by which these men were surrounded rather than to their devotion to a special line of farming. But this suggestion is shown to be wholly at fault by the fact that scattered through the various towns in which this tobacco mania raged, were many farmers who did not deviate from their old style of managing business, and who have gone straight through these troublous times without financial embarrassment, whose work has paid them well, and who are now regarded as successful farmers by men who a few years ago thought them "old fogies," and were sure that they were lacking in enterprise as well as in judgment. The test has been very severe, and the lesson is well worth remembering. Let no one think that fancy has heightened the colors of this sketch of the tobacco interest. We have lived in the midst of the excitement, and have seen the results. We know whereof we do affirm, when we assert that the making of tobacco a specialty was a ruinous experiment. Yet many things were favorable for its cultivation. A very fine quality of leaf was secured, and when tobacco was in

demand this grade sold for a high price. Probably some tobacco might have been grown without involving pecuniary loss. Merely from a financial standpoint it might have paid well. The trouble was chiefly caused by making its production a specialty. And trouble of like nature, though of less extent, will be liable to come to farmers who engage in any specialty to the exclusion of all other productions.

The idea, advocated by the specialist, that the man who gives his whole time and attention to the production of a single crop can grow that crop to better advantage than he could if he gave it only part of his time and attention, is undoubtedly correct. The weak place in the argument is to be found in the fact that when this crop is grown the owner has only one product on hand while he needs many. For him to obtain these products is not merely a matter of convenience, it is a case of necessity. Then, too, the specialists have an idea that certain crops can be bought cheaper than they can be raised, and they bring this reasoning to bear upon almost every crop which the farmer can grow. They seem to think that they can prove by figures that each and every farm-crop costs more to produce than it sells for in market. That this is false reasoning is abundantly proved by the fact that the average farmer supports a family and pays taxes without running into debt.

If the theory of the specialists were true, the harder they worked the more money the farmers who grow the ordinary crops would lose. It is not uncommon to hear farmers in the older States assert that it costs a dollar a bushel to grow Indian corn while it can be bought for sixty-five cents, and to reason from this that a farmer had better not try to grow this crop. That there is a mistake in their figures is proved by the fact that our most successful farmers are corn-growers. If any other crop is taken as an example, men will be found in every farming community who will assert that its selling price is far below its real cost. It is generally impossible to convince these men by

taking a single crop for an example, but even they can see that the farmer cannot buy *everything* which he uses. Unless he cultivates some crop which he can either sell or use he will speedily find his way to the poor-house. As a general rule, the nearer he can come to supplying his own wants the more successful the farmer will be.

We think there is a very strong tendency in all parts of the country to abandon all exclusive specialties and adopt a system of diversified farming, and we are glad to note that many of the leading agricultural journals strongly favor this change. In some sections it is becoming almost a necessity for the farmer to increase the number and variety of his crops. The specialties which have long been almost exclusively grown have nearly exhausted the soil of the particular elements of which they are composed, and the crops which are now secured are small and rapidly becoming unprofitable. A system of rotation of crops will give a great deal of aid in restoring the fertility of the land and increasing the quantity of its productions.

Not only does home production secure a fair reward for his labor, but it also insures to the farmer a good degree of independence. This is an important element and must never be omitted from the account when the profits of various methods of farming are under consideration. The farmer who is doing a large business in one direction and attempting nothing else is not as independent as the one who does much less but grows many different crops. At first glance it may seem as if this division of his energies would be a ruinous thing, but closer inspection will prove it to be very beneficial.

In order that our meaning may be clear we will suppose two cases. The first is that of a farmer who makes wheat-growing a specialty. As far as farming is concerned, his whole attention is devoted to the production of this one crop. He strives to grow it as cheaply as possible, and bends all his energies to the accomplishment of this one aim. He is an intelligent man and

is reasonably successful in his endeavor. He grows a large quantity of good wheat and has no difficulty in selling it when there is a call for this kind of grain. Occasionally, when the prices are very low, he holds on for an advance. As a general rule this does not prove a good method, and he usually sells for the market rates. In order to grow as large a quantity as he desires he is obliged to keep several horses and a few hired men. Both the horses and the men must be fed, but neither of them can subsist on wheat alone. Meal must be bought for the team and many articles for the men. Even hay is purchased by some farmers who are engaged in growing specialties.

While the income from the sale of the large lot of wheat is considerable, it is secured at a great disadvantage. The soil, as already shown, will either be rapidly exhausted of some of the most valuable mineral elements of plant-food or else these elements must be furnished by the owner at a great and constant expense. It makes a great difference with the profit of a crop whether the manure which is needed for its growth can be obtained from the farm, without any direct expense, or must be purchased at high prices and paid for in cash. If a man is obliged to pay several hundred dollars every year for fertilizers it will not only reduce the profits of his business, but, in a few years, this money with the accumulated interest will amount to a large sum. In order to return this money with interest, and over and above these items pay for the labor which is performed, interest and taxes on the land and other capital invested, and keep this capital unimpaired besides paying the other and inevitable costs of production, the wheat crop must return a very large sum. After deducting these items many wheat-growers would have but little, if any money left.

But when this crop is made the only reliance, the farmer and his family must be supported from its proceeds. It should return enough not only to pay all the expenses of its production but also to keep the family in comfort for at least a year. This

is not all. On a farm managed in this manner the labor is performed at a great disadvantage. Much of the time both men and teams are comparatively idle. There is nothing which can be done for the wheat, and there is nothing else to do anything for. But the pay of the men and the expense of keeping the teams go on without reduction.

When time for work comes the labor is very hard and exacting, but it must receive prompt attention or else great loss will result. This way of working is not as conducive to health as the slower and steadier methods of toil which are followed where many different crops are grown.

Again, in selling the wheat crop and buying family supplies there is quite a percentage of loss which it is usually impossible to avoid. This will appear when we reflect that the wheat which the farmer disposes of to the dealer is sold for the lowest wholesale rates. Every man through whose hands it passes charges a profit thereon, and by the time it reaches the consumer the price is much higher than the farmer was able to obtain.

The same principle governs the sale of all other products. Consequently, while the farmer sells his wheat at the very lowest market quotations, when he comes to buy the products of other farms he becomes a consumer and is obliged to go to the other end of the scale and pay the high retail rates. Had he produced these things himself, he could have had them all at wholesale prices, but in preferring to grow wheat with which to pay for them he loses the difference between these two extremes. This is a matter of no small importance. It costs a great deal to support a family when the purchases of supplies are all economically made and the average farmer has no money to waste or to lose in unprofitable exchanges. With the present styles of living and dressing there will be a necessity for as much buying as the farmer ought to do if he produces all that he can at home.

Let us now consider the method adopted by the farmer who believes in home production. He does not devote his whole attention to the culture of any particular crop, but endeavors to grow many kinds and grow them well. He desires to obtain a good grass crop, at a cost not exceeding its real value. To secure this he keeps a good stock of cattle to which the hay is fed. The manure from these cattle is applied to the various cultivated crops, and much of it remains to enrich the soil and produce grass after the crops to which it was originally applied have been removed. Good wheat is succeeded by good grass which remains productive for several years. As milk and butter are wanted for family use, a few good cows are kept to furnish a supply. Corn is grown for the purpose of feeding the hogs and for fattening the beef which is needed in the family. Oats are frequently wanted for horses and young stock, and are produced on the farm. Either wheat or rye, and in many cases both, find a place in sufficient quantity to furnish the family with bread. Roots and vegetables are also grown in abundance, and poultry is kept to furnish eggs and meat. In short, almost every vegetable and animal production which the farmer needs and can grow is given a place on his farm. This adds considerably to his work, it is true, but it also greatly reduces the household expenses. The farm, as a whole, is kept in much better condition and at a much less expense than is usually done under the one crop system, and much of the extra work which is required is done at those times in which both men and teams would otherwise be unemployed.

By this system many of the wants of the farmer and his family are not only supplied, but there is often a surplus of the various products which can be exchanged for articles which cannot be produced on the farm. Eggs can be exchanged for tea and coffee, and butter can be made to pay for many of the little things which the grocer must furnish. Poultry can be exchanged for other meat, if desired, and vegetables are often given in pay-

ment for other classes of goods. Thus, instead of being obliged to sell all that he grows and pay cash for all that he buys, the farmer can exchange many of his products for things that he needs. Of course, these products cost him something, but they do not, at least do not need to, cost him as much as he receives for them. Thus there is a direct profit on the articles which he exchanges as well as a saving in furnishing these things instead of money. Take the hens for an illustration.—It costs something to keep them, but if they are properly managed this cost is considerably below their selling price. Then, too, the hens pick up a great deal of material which they can utilize, yet which but for them would be wholly wasted. The production of sugar on the farm is another good illustration of the profits of home growing of all the household necessities that the farm can supply. If the farmer attempts nothing of this kind he is obliged to pay quite a sum every year, often several dollars every month, for sugar and molasses. But if he has a maple orchard, or, where this is impossible, grows sorgo or the sugar cane, he can obtain nearly all of these materials which he will need for a very small outlay in money. Some labor will be required, but it will be labor which is well rewarded. If either sugar cane or sorgo is grown and the business of the farmer is not large enough to warrant the purchase of a mill, there can generally be found neighbors enough to club together and buy one to be used in common, or else some one in the vicinity already possessing a mill will work up the cane for a share of the product. In either of these ways, one of which will be found feasible in all sections where either the Sugar (Ribbon) Cane or Sorgo can be grown, the home production of sugar can be made very profitable, while the manufacture of sugar and syrup from the sap of the Maple tree requires so small an investment that any farmer who has a good sugar orchard can easily obtain the few and simple implements which he will need for making it productive.

• Other illustrations might be given, but enough has been said

to show the far greater degree of independence of the farmer who attempts to supply his household wants, than can be enjoyed by the one who makes a specialty of a single crop and gives all his time and skill to its production. But this chapter ought not to close without calling attention to the great risk which the specialist is constantly obliged to run. If his hopes are all centred upon the wheat crop, and all of his income as well as all the material for supplying his household necessities must come from this one product, and for any reason wheat proves a failure his loss is very heavy. We all know that wheat sometimes fails to produce a paying crop and that other grains are subject to similar risks. From this we should infer that farmers would much rather grow several crops than to stake everything upon a single one.

If a man grows wheat, and corn, and oats, and potatoes, there is no probability that the season will be so unfavorable as to destroy all of these crops. The wheat may be injured, and the other crops saved. Or one or two of the other crops may suffer, and the remaining ones still do well. This matter of comparative safety is a very important one to all farmers of limited means. A wealthy farmer does not like to lose all the crops of a whole season, but he will not be wholly ruined by such a loss. The poor man, however, who has all that he can well do to keep along when things go reasonably well, cannot afford to take any extra risks. With him safety and certainty should be the principal conditions and recommendations to be required in the selection of his crops. The man who follows this course will not handle as much money as the specialist will obtain in favorable seasons, but he will have much more comfort and less anxiety, and will be very likely to find more real profit when he balances his books for the year, than the man who has grown only one crop can show. For it is not, by any means, the amount of money which men receive which makes them rich, but the amount which they are able to save, and a small

business which is properly managed, and in conducting which but few expenses are involved, will often pay much better than a large one in which the expenditures are both large and constant. The old proverb, "a penny saved is a penny earned," has a great deal of truth in a very small compass. If by growing an acre of wheat the farmer can save the payment of twenty dollars for flour which his family needs, he has really secured as much as though he had earned that amount of money, and then exchanged it for flour. This principle has a wide range of application, and should always be remembered by the man who desires to be a successful farmer.

Not only does the general principle of home production seem to be a safe and desirable one for the farmer to follow, but the tendencies of the present time, and the condition of the soil in large sections of the country, both point to its adoption as far preferable to any other plan of cultivation which has yet been tested. It is not as easy to obtain money now as it was a few years ago, but the great necessities of food and clothing are in just as good demand, and are just as truly required as they ever were. That they always will be needed is evident, and it also seems clear that the man who labors to supply them, as far as possible directly from his own farm, is taking the wisest course which he can pursue. The worn out tobacco-lands of VIRGINIA, the exhausted cotton-fields of several of the SOUTHERN STATES, the rapidly decreasing yield of the great wheat-fields of the WEST, and the exhausted rye-fields of NEW ENGLAND, all seem to demand a system of diversified farming which shall check this ruinous exhaustion of the soil, and at the same time secure to the husbandman a higher reward for his labor, and a greater certainty of success in his business than the present methods enable him to obtain.

OVER-PRODUCTION.

THIS is one of the great evils with which the farmers of the present day are often obliged to contend. It is an evil which it is somewhat difficult to modify, and still more difficult to remove. Owing to their great numbers, the want, if not the impossibility, of close organization, the wide differences in the soil and climate, and the constant fluctuations in the demands of both the local and the foreign markets, together with the fact that they are scattered over a vast area, the farmers are, more than any other class, exposed to losses from over-production.

In order to modify, and if possible prevent, the evils resulting from over-production, a wise selection of crops should be made. The farmer must decide for himself which crops shall be grown, and the quantities in which they shall be produced. But his judgment should be based upon sound and extensive knowledge. He should take the papers which give accurate market reports, and should carefully study the figures which they present. He ought to be informed concerning the crop prospects, and in regard to any extensive changes which may be going on in different sections of the country. But he should not often change his crops in hope of securing those which sell for the highest rates.

There are many farmers continually changing crops in order to obtain high prices. This would be bad, even if the desired rates were secured. But it generally happens that those who rush after the spoils are a little too late. They increase the supply to such a degree that the price goes extremely low. Meanwhile some other crop, the culture of which has been abandoned by many farmers for that of the one which was selling high, becomes scarce, the price rises, and another change is made. Then there are a few years in which the crop which the changing ones left sells well, while the one which they have

selected follows the course of all such crops when the supply largely exceeds the demand, and the price runs down below a paying figure. In this way some farmers are constantly going the rounds, always a little too late to get the highest prices, and holding on long enough to sell for the very lowest ones. This is a ruinous course. The farmer has to sell his crops for less than they are worth. The constant changing prevents the following of any suitable system of rotation, and the cost of production is largely increased. Of course, there may be circumstances in which it will be best to change the ordinary rotation of crops. But frequent changes which are made to gain the benefit of high prices are very unprofitable.

How shall the farmer protect himself from the evils which, often in spite of his individual action, over-production threatens to bring upon him? We know of but one method which promises to be effectual. That is by furnishing only the best grade of articles. It is said that when DANIEL WEBSTER was a young man and thinking of studying law, some friend asked him if the legal profession was not already crowded. He replied that it was, but added the significant remark, "there is room enough at the top." He worked his way to the top, and became a brilliant lawyer. While inferior men, or men who had made a poorer use of their abilities, had small fees and but little to do, MR. WEBSTER was liberally paid and had all the business to which he could attend. This principle will be just as powerful an aid on the farm as it was in the law office. The best farmer will be successful. The man who has the finest wheat in the country can sell it even though multitudes of growers who have only a poor grade are obliged to wait long for a buyer. Even in a time of the greatest plenty farm productions which are strictly first-class will sell. They may not command as high prices as the owners desire, but they can be converted into cash at times when the poorer grades cannot be sold. It is often the case that first-rate fruit will sell for a high

figure when a medium grade will go far below its actual worth, and no buyers can be found for a poor one. The best peaches are not thrown by the car load into the docks at NEW YORK. All the nicest ones which reach NEW YORK, or any other city, in good condition, are sold. It is the poor, unripe specimens which are thrown away. The finest grains and nicest fruits, and all other first-rate farm products, can be sold. They will not only sell for higher prices, but also in larger quantities than poorer grades. A family will consume more good butter than it will poor, and will be willing to pay a higher price per pound. The same principle applies to all other farm products. Our cities and towns are full of people who must have the products of the farm. Many of these people are poor and must buy the cheapest grade they can find. But there are multitudes who are in good circumstances, and who will not buy a poor grade if they can get a better one. They are not able to pay the extreme fancy prices which a few wealthy parties give, but they are both able and willing to pay well for what they buy if it is really nice.

There has been, is now, and perhaps there always will be, an over-production of poor butter, poor fruit, poor beef, and a low grade of almost everything else which is sold from the farm, but the man who has a nice grade of any standard farm product need not keep it long on hand. Whatever may become of the poorer kinds, his own products will sell. Let the farmer who fears that over-production will be the ruin of the country, take special pains to secure the finest quality in the goods which he takes to the market, and he will soon find that there is a demand for all the products which he can supply.

GOOD SEED.

IT must be evident to every thinking man that there is no one thing which the farmer can do with perfect confidence that it will insure the production of a good crop. There are many operations which are essential to success, and while no one of them alone can meet all the requirements of the case, no one of them can safely be left out. It is absolutely necessary that the land should be well prepared, but if nothing else were done the best preparation in the world would not produce a crop. It is also necessary that good seed should be used, but even this alone will amount to nothing. There must be a good soil, a suitable preparation, and proper culture of the growing plants, in connection with the use of good seed, if the best results are to be secured.

For some reason which is not plain to be seen, the selection of the seed as one of the leading elements in the production of large and profitable crops, has never received the attention which it has deserved. Other matters seem to have engrossed the attention of most of the men who have made agriculture a special study. They have been engaged in trying to discover new varieties, to learn the best methods of fitting the soil, and in developing new systems of cultivation. Meanwhile the practical farmers have gone right along in the old way of using seed from their own crops, and without making a careful effort to select that which was the best fitted for their purpose. There have been some individual exceptions to this rule, but the general practice has indicated a great lack of interest in this very important part of their work. The study and thought which have been given, and the experiments which have been made in these other directions, have led to valuable results. The labors of men who have been engaged therein should be gratefully recognized, and farmers should cheerfully avail themselves of the benefits which have thus been placed within their reach.

But in addition to all the light which has been obtained, and all the advantages which have been secured in these directions, there is need of a clearer realization of the fact that the seed exerts a controlling influence upon the quantity and quality of the crop. It is for want of attention to this fact that so many efforts to obtain large yields have failed of success. In some of these cases all of the conditions except this one seem to have been complied with, but the seed which was used was not the best, and the best results were not obtained. Just as long as effect follows cause, just so long will it be impossible to secure first-class crops from second-class seed. We know that in the animal world the character of the offspring is determined by that of its parents. We can have the same assurance concerning the individuals of the vegetable kingdom. The seed as surely determines the character and appearance of the crop which it produces as parents impress their characteristics upon their children.

Let us consider some of the powers and qualities which are, or should be, possessed by the seed of our ordinary farm-crops. In some inexplicable manner there is hidden in every well-developed seed a mysterious quality called *VITALITY*. This quality enables the seed, when placed under certain favorable conditions, to germinate, and thus commence the series of changes which will result in the production of other specimens of its kind. As long as the seed is kept intact this power lies dormant. When it becomes active, a change in the character and appearance of the seed is manifest. The interest of the farmer requires that this change shall take place only in those specimens which he uses for the production of future crops, and that they shall remain in their natural condition until, or very nearly until, the time when they are cast into the soil. For, the process of growth injures the seed for other purposes, and if it takes place long before the seed is planted, spoils it for reproduction. Consequently, it is for the interest of the farmer to

keep his ripened grain as much as possible from all untoward influences. If his wheat, which is in the stack, is for several successive days exposed to warm and wet weather, much of it will sprout. In other words, the vital principle becomes active, chemical changes are effected, and growth is the result. In such circumstances growth inevitably means injury, and this injury is very closely in proportion to the extent to which the changes are effected. If the rain is of short duration, and the kernel merely absorbs a little moisture which is soon evaporated, no great harm is done. But if the rain continues, and the kernel keeps on absorbing moisture, in a short time the starch which it contained, and which is absolutely necessary to the production of nice flour, is converted into sugar, which is considerably diluted with water. As the process continues, the sugar which has been formed is changed to cellulose, and the kernel is wholly ruined for flouring purposes. The conversion of the starch into sugar before the kernel is planted also injures it for seed, because the plant cannot live for any length of time away from the soil, and unless the seed is at once put into the ground all the growth which has been made will be wholly lost. The young shoot will very soon wither and die.

This is not all the injury that has been done as we shall see at once when we reflect that the starch which was stored in the kernel was just the kind of food which the plant requires for its nourishment until its roots become strong enough to obtain food from the soil and its leaves are developed enough to secure the materials for growth which are furnished to all plants by the atmosphere. But the process of sprouting through which the kernel has passed has changed the materials of the seed and partially used them as food for the plant which had become partly developed. When such a seed is planted it will absorb moisture, but there will be no starch and but little sugar upon which the plantlet can feed. Some seeds will only sprout once, and if the process of germination is checked it cannot be

renewed. Other seeds will endure some interruption, though they are greatly injured thereby. From this it will be evident that the selection of seed is a matter of importance to the farmer, and that in making the selection he should be careful to obtain only that in which the quality described as vitality is unimpaired.

Another quality which some seeds possess, and which should always be sought when a selection is made, may be described as VIGOR. This can never be present without vitality, but there can be vitality without vigor. There are men in the world who are alive but who possess but very little vital force. It requires about all of their strength to maintain their feeble hold upon life. The same principle applies in all of its fulness to the case of plants. In a great many fields of grain plants can be found which, while living, are but little better than dead. They will grow for a while, and the fields may look a little better for their presence, but the difference which they will make in the yield of the crops will be very small. From these extremely weak specimens there are various grades of improvement until we reach the plants which are full of life and strength. Each and every stalk of these several grades has power to produce seed after its own kind. If the seed from the strongest plants is saved to furnish the germs for a future crop, the plants which will be secured will, if circumstances are favorable for their development, be almost sure to be strong and vigorous. But if seed is saved from the weak stalks, the product of that seed will be very likely to be still weaker than the parent stalks. The grade of plants can be lowered much more easily than it can be raised. The natural tendencies seem to be downward rather than toward a higher type. Still, this tendency can be counteracted, and the various kinds of plants can be greatly improved by careful selection combined with good cultivation.

The facts that the seed has a strong power of impressing its own characteristics upon its product, and that this power is

somewhat modified by a natural proneness to seek a lower level, should induce farmers to make a very careful selection of the seed which they design to use for planting. They also show very plainly why some farmers who have good land and give good culture do not obtain paying crops. These men are not careful in making a selection of seed, but take about an average lot for this purpose. In this there is the product of some stalks of each of the several grades of vigor. While part of the seed was produced by the best stalks, much of it came from the weakest plants. The grains from the best stalks will probably yield a good crop, but those which came from the lower grades will be very sure to have all the undesirable qualities of their parent plants. If we sow seed from weak plants we must expect to have weak plants for our product, and if our crops are largely composed of weak plants, they will be both small and unprofitable.

Another quality which seed should possess is PERMANENCE OF CHARACTERISTICS. This is an important quality and one which a great deal of seed does not possess. It can be secured by careful selection of the seed which is used in a series of years. Without it there is a great deal of risk that the crops will be poor. In their efforts for the improvement of seeds, horticulturists often have a great deal of trouble to fix the characteristics of certain specimens which they wish to preserve, and it often requires many years to enable them to secure the desired result. But when permanence has once been established it can be retained by carefully selecting the seed which is to be sown. If this selection is neglected the variety will show a strong tendency to run back to its original condition. The common carrot furnishes an illustration of this. As long as the seed is carefully saved from good specimens, and proper cultivation is given, the crops which are obtained will be like the ones which produced the seed. But if there is carelessness in producing the seed, or culture is neglected, it will be but a short time before

the useful carrot is changed into a worse than useless weed. Many crops retain their distinguishing characteristics much better than the carrot, but with all plants there seems to be a strong tendency to revert to some former style of growth and appearance. It requires a vast amount of patient effort to firmly "fix" the characteristics of new kinds of grain. In selecting seed the farmer should keep this fact in mind, and not only secure seed which is good in itself, but also that which will, under good cultivation, produce its like. And when this characteristic has been secured it can, and should, be maintained by means of careful selections of seed for future crops.

EARLY MATURITY is another quality which the seed of farm crops should possess. In the minds of many farmers this quality is generally associated with a dwarfish habit of growth and a light yield of grain. But these things do not always connect themselves with an early ripening of the seed. Still it is quite natural that the longer the time which a crop requires in which to mature, the larger it should grow, and we find that many of the very large varieties of grain are late about ripening their seed. Perhaps if plants were left wholly to themselves this would be a universal rule, but under the present methods of culture there are many exceptions. With some varieties man has long been experimenting in order to change the time of ripening, and his efforts have been very successful. Some medium-sized varieties of corn have been made to ripen some weeks earlier than their original time, and this has been accomplished without diminishing the size of either stalks or ears and without decreasing the yield per acre. For grain which is grown in the NORTHERN States this is a valuable characteristic. In some unfavorable seasons the question whether corn could or could not be ripened has turned wholly upon the possession, or the want, of this one quality. In NEW ENGLAND, and also in several of the WESTERN States, it sometimes happens that the warm season is very short. Spring opens late and cold, and frosts come very

early in Autumn. In such seasons the seed cannot be safely planted until quite late, and unless the variety matures early the frost will find the grain unripe and cause it serious injury.

Every farmer who has handled the corn crop knows that well-ripened grain is worth a great deal more than that which is not fully matured. Even where it is almost ripe the corn is deficient in some of its most valuable qualities. The fodder, which in many States is considered valuable for feeding purposes, is also badly damaged by frost coming upon it before it is cut and cured. In unfavorable seasons it is almost impossible to obtain well-ripened crops when the late varieties are planted. It is true that such seasons occur only occasionally, that they are the exception and not the rule, but it is also true that they are frequent enough to justify the farmer in an effort to avoid evil results from their appearance. At such times the earliest and smallest varieties pay better than the large and late sorts. But as already intimated, the qualities of size and earliness do not necessarily conflict, and by taking a little pains to secure the best seed, farmers can supply themselves with varieties which will be large enough to satisfy all reasonable demands and early enough to ripen in a short and unfavorable season.

PURITY.—This is another quality which the seed of farm crops ought always to possess. By this term we mean not merely the quality of producing its kind, which has already been considered, but perfect uniformity of appearance. In this respect an immense amount of seed which farmers use is deficient. Instead of taking pains to have their corn all of one variety, or if different kinds are cultivated to plant them in fields distant from each other, too many growers allow several different kinds to mix and make no effort to secure purity of the seed. In a few cases this may be due to the impression, which some farmers have, that corn will “do better” if several sorts are mixed than it will if only one variety is planted. This idea is wholly without a reasonable foundation, and the more farmers read and study, the

less it will prevail. In most cases the use of mixed seed is due to a want of thought and care rather than to any belief that it is superior to that which is pure. Instead of being better the impure seed is far inferior to that which is unmixed. To any one who will think carefully upon the subject this will be evident.

Take a case for illustration. Suppose in a certain lot of seed-corn there are mixed four or five varieties. These sorts do not hybridize, that is, do not unite to form new and permanent varieties, but merely mix, and the result is that on one ear many kernels of each of the kinds which are represented in the field may be found. Now as these kernels are not alike it is almost a necessity, and it is certainly a fact, that some of them will be superior to others. If this is the case, it follows that while part of the mixture is good, part of it is, and must be, inferior. Consequently, as a whole, the corn obtained is not first-class. In order to be first-rate, all of it should be equal to the kind to which the best specimens belong. Thus, as far as quality goes, it is plain that the best grade cannot be secured from mixed grain. Part of the lot is superior to the rest, and the moment the poorer grades are left out and only the best one is used, the mixture is destroyed.

Another thing to be considered in using mixed seed is the fact that the various kinds which are represented cannot all ripen at the same period, and that when part of the grains are ripe enough to harvest, the remainder may be altogether too green. As it is of great importance to have grain ripen uniformly, this objection against mixed seed should carry considerable weight.

But the principal reason why strict purity of seed should be secured and preserved may be found in the fact that this would enable the grower to obtain quite an increase of the price which his mixed grain now commands. This is not a mere supposition, but a solid truth, and one in which farmers who are engaged in

growing grain are deeply interested. It is a fact which dealers have long recognized and to which they have often called the attention of farmers. Several years ago the Board of Trade in one of our WESTERN cities issued a circular to the farmers in the corn-growing section, in which they complained of the mixing of different kinds, and stated that the price which the grain would command in market was at least three cents per bushel less than it would be if the corn was all of one color and belonged to some one variety. In this circular farmers were advised to be more careful in selecting their corn for seed, and were urged to attempt to secure a greater degree of uniformity in the character and appearance of the crop. Some farmers followed these recommendations, but that they were too generally disregarded the present appearance of WESTERN corn places beyond doubt. The way is still open for improvement and the need of it is beyond dispute.

If corn-growers could be made to realize that their grain would command three cents per bushel more than they can now obtain for it, they would, doubtless, be willing to make an effort to obtain better seed. The men who buy corn judge of it very much by its appearance. They do not want to pay high prices and they make use of every imperfection as an argument in favor of low rates. If a lot of corn is neither white nor yellow, and does not belong to any known variety, buyers will not be willing to pay as well for it as they would if it was pure. On a single bushel the increase in price which could be secured, if sufficient care were taken to grow pure and good varieties, would be small, but on the quantity which a large corn-grower will raise in a period of ten years it would amount to quite a sum and would add considerably to the profits of the farm. An advance in price of three cents per bushel on the corn crop of one year would put at least *six millions of dollars* into the pockets of the farmers in the one State of ILLINOIS. The expense involved in securing this immense amount of money would be very small.

There would be no extra cost for planting, cultivation, or harvesting. The extra price of seed would be but a trifle for the first year and nothing afterwards. Almost the whole amount would be clear gain. In several of the other corn-growing States from one to three millions of dollars per year might be made by the farmers, if they would give proper attention to the selection of corn for seed. Here is an opportunity for those who will give a little time and thought to the selection of seed to make a larger profit on the corn crop than they have yet been able to secure.

PRODUCTIVENESS.—This is another quality which should be sought in selecting seed. There can be no doubt that some seed possesses this quality in a high degree, while other specimens, which to all appearance are just as good, are very deficient in this respect.

This point has not received the attention which it deserves, and many farmers are slow to believe that there is any particular difference in seed as far as its productive powers are concerned. They know that certain trees are more fruitful than other specimens which are as favorably situated, and they cannot escape the conviction that there is a quality of productiveness which is inherited by different trees in different degrees of intensity. But when they are told that plants also possess this quality, and that the yield of a crop will be largely determined by the degree in which it has been inherited by the seed, they are incredulous. Variations in the yield of corn they ascribe to difference in soil, or variety, or fertilizer, or the time of planting, rather than to any power in the seed itself. But sometimes when in adjoining fields, in which the soil is as nearly alike as soils can be, the same varieties are planted, and there is no difference either in the cultivation or the manuring, but a great difference in the quantity of grain which is harvested, they are almost compelled to acknowledge that there is a difference in the productive powers of seed which belongs to the same variety, but is produced by different specimens of plants.

Careful experiment has proved to the satisfaction of all unprejudiced parties who have studied the results that the quality of productiveness is strongly developed in some plants, and possessed in only a slight degree by others, and that the plants communicate these characteristics to the seed which they produce. In the *SCIENTIFIC FARMER* for May, 1877, is the record of an experiment with different grades of corn which looked equally well, and which were planted on a field which had given good and uniform crops. The field was divided into three plots. One of these received no manure. The remaining two were well-fertilized. Upon the one without manure and one of the two upon which manure was applied, the same kind of seed was planted, while upon the remaining manured plot another kind was used. The result was that the land without manure, upon which the most productive seed was used, yielded at the rate of sixty-eight and three-fourths bushels per acre, the manured plot planted with the same kind of seed produced one hundred and ten bushels per acre, while the manured plot on which another kind of seed was used only yielded fifty-five bushels per acre. Here the evidence is clear and convincing that the seed made a difference of thirteen and three-fourths bushels per acre over and above the influence of the manure, and that the difference in the seed made all the difference between the yield of the two plots which were manured—a difference of fifty-five bushels per acre. With the same kind of soil and culture, and an equal quantity of manure, the best seed produced just twice the amount of grain which was obtained from the inferior seed. Yet these two kinds of seed did not present any evidence in their external characteristics by which one could be proved better than the other, and it is highly probable that the poorest seed used in this experiment was in every respect fully equal to a large proportion of the seed used in the country. Comparatively few farmers obtain an average yield of more than fifty-five bushels of corn per acre.

This experiment also throws some light upon the question of economy in buying seed. Only one peck of corn is needed to plant an acre. Many farmers do not use as much as this. But if a peck is used, and the common quality of grain is selected and carefully shelled, it will be worth somewhere from fifteen to twenty-five cents. If the very best seed is obtained, the cost, with transportation charges, may be two dollars. The difference in the cost of seed enough for an acre will be from one dollar and seventy-five to one dollar and eighty-five cents. The cost of planting and cultivating will be the same, but the difference in the yield will be from forty to fifty-five bushels.

We do not believe that a farmer should buy everything that is offered for sale, but we are confident that if the varieties of grain which he is growing do not yield well, that if with as high manuring and as good cultivation as his neighbors give, he cannot obtain as large crops as they secure, it will be wise for him to change the seed with a view to obtaining some which will be more prolific. We have experimented somewhat with various kinds of corn, and have found a great difference in the yield of varieties which looked quite well. And we have found that some farmers have grown corn year after year which was very handsome, and which they supposed was a very fine variety, when it was greatly inferior in productiveness to kinds which produced just as good grain, and which were grown in their own neighborhoods.

In order to be sure that his corn is reasonably productive, every farmer should keep an accurate record of the yield per acre each year. Otherwise he may be deceived, and think he is doing well when his crops are far below what should be their average yield. If he has a prolific variety, he should be careful in selecting seed and do all that he can to stimulate and develop this quality. If he is growing a variety which is not as productive as it should be, it will be greatly for his interest to make a change as soon as possible.

The same principle applies with equal force to other farm crops. We used the corn crop merely as an illustration. In many States other crops are of still greater importance. Whatever the crop which the farmer wishes to grow, and whatever the facilities which he may have for its production, he may accept it as a settled and forever unchangeable principle that good seed is an essential element in its successful cultivation. Without this he cannot obtain the best results, or anything approaching them, and it is utterly useless for him to make the attempt. If at any time he feels that the price of first-class seed is too high to justify him in purchasing, he should reflect that whatever good seed may cost it is absolutely certain that he *cannot afford to use inferior seed even though it costs him nothing.*

THE SELECTION OF SEED.

LIKE all other things of value good seed has its price, and only by the payment of its price can it be obtained. It is not produced by chance, and it does not perpetuate itself certainly and for an indefinite length of time. Knowledge, care, and skill on the part of the grower are all absolutely necessary to its production. It is only by a patient, careful, and wise selection of the plants, or roots, or bulbs, that the finest seed can be secured. The careless, hap-hazard way in which many farmers and gardeners save the seed which they plant, accounts, in a great measure, for the poor quality of the seed itself and the light yield of the crops which they obtain therefrom.

Good seed is not produced by every plant, and if no care is taken in selecting the plants for seed, the choice of many inferior ones will be inevitable. The average product of an ordinary field is very far below what should be taken as a standard by which to measure plants for seed. The very best plants which

can be obtained are none too good for the production of seed. The man who saves the poorest part of every crop for seed will soon have very small crops. When the average product of the field is saved the yield does no more than hold its own and keep up the average. It is only when the finer plants are saved for seed that the yield increases and a manifest improvement of the quality is secured. Even then, if there has been no careful guarding of the plants, during the period of their growth, against the various adverse influences which inevitably surround them and no thorough culture has been given, the quality of the seed secured will fall far below the grade which might have been obtained.

It very often happens that men are careful in saving the largest and finest ears of corn for seed and yet fail to obtain as good crops as they think they have a right to expect. The cause of their want of success is easily explained. The kernels of the fine ears in which they placed so much confidence were fertilized by the pollen of inferior stalks. A mongrel calf may look as well as a thoroughbred, but no one who understands physiological laws, or who has had much experience with cattle, would have any confidence in such a calf as a breeder. However fine the individual may be, it does not possess, and consequently cannot transmit, any fixed characteristics. It is a slow process to form a distinct breed of animals. There are so many sports and reversions that even the experienced and skilful breeder finds the obstacles to success almost insurmountable. It is fully as difficult a matter to breed plants to a desired form. But this can be done by the skilful cultivator. It may take a long time—perhaps a longer period than the life of any one man may be required in order to bring the plant as near perfection as possible—but time, and patience, and skill will develop a wonderful improvement.

The great difference between the potato and the tomato will serve to illustrate the modifying power of cultivation and breed-

ing. These plants are alike in their botanical structure. Both, in their natural state, bear fruit on top of their vines. The potato balls have not been used by man. His efforts for the improvement of the potato have been directed to the tubers. The balls, which are a similar product to the tomatoes, have been left to take care of themselves. But with the tomato a very different course has been pursued. The efforts of a large number of cultivators have been directed toward the development and improvement of the fruit of the vines. The result of this different treatment is indicated by the difference in size, appearance, quality, and productiveness of the vines of the potato and the tomato. The finer sorts of the tomato when compared with potato balls show what can be done in the line of improving the fruit of plants.

As a large part of the profits of the farmers' business come from the growth of plants and their sale, or the sale of their products, it is a matter of great importance that they should secure the very best plants which can be obtained, keep them up to their present standard, and make a constant effort for their improvement. In order to be fully successful in this work it is necessary for the farmer to begin at the beginning. By starting at an intermediate point some benefit may be secured. But the results will be far more uncertain, much time will be wasted, and frequent failures will be inevitable. The first thing to be done is to get the best seed which can be obtained. Some variety adapted to the soil, climate, and mode of cultivation pursued should be selected. If the farmer has good seed of this kind he can use it, but if he has only an inferior grade he should obtain a supply elsewhere. The good seed may not be good enough to transmit its good qualities in perfection. Like the mongrel calf, it may be good itself and yet not be able to breed true to its own characteristics. But there is more hope in breeding from a good calf than there is from a poor one. The good one is nearer the mark than the other and will be much more

likely to produce good stock. The same is true of plants. In working from the best which can be had there is less distance to pass and the road is more direct than will be the case if we start way back with a poorer specimen. The first thing, then, to be done when an improvement in the yield, quality, or appearance of plants is desired, is to either select from home resources or obtain from abroad the very finest and nicest seed which can be secured.

In selecting seed from which to develop a better class of plants, care must be taken to secure that which presents the desired characteristics in a marked degree. Some plants have a strong tendency toward beauty of form and appearance, others are very fragrant, while the leading characteristic of others is productiveness. Now, if a man wants to develop the element of beauty, he should start with a plant which is already beautiful. If fragrance is desired, the most fragrant flower should be taken as a starting point for increased development. If productiveness is specially desired, the most productive plants in the field should be selected and their fruit saved for seed with which to increase and extend the productive power. These varied qualities might be secured if plants were taken which did not possess them in an unusual degree, but it would require more skill and several years longer time to secure the desired result. The stronger the impress of the wished-for peculiarity which the plant already bears, the more certain and powerful will be its manifestation in the productions of that plant in the next generation. There may be difficulty, and much time may be required, even when strongly marked specimens are used for propagation, but the difficulty will be less and the time will be shorter than will be needed if only ordinary plants are taken.

The double rose is a fine example of what can be accomplished in the line of beauty by careful culture and thorough breeding. The structure of the rose flower is, naturally, like that of the common apple-blossom. The form of the original

rose was, and the form of many of the wild, uncultivated roses is, with the exception of size, the same as the blossom of an apple tree. No effort has been made to change the form of the apple blossom, but gardeners have long been at work upon the rose, and have succeeded in obtaining perfect double blossoms entirely destitute of stamens and pistils. When this point is reached, perfection has been secured. The skill of man can go no farther. But with this perfection, the reproductive power of the plant is obliterated. There are no seeds from which to produce new specimens. Many kinds of plants can be brought to this stage. But the species can be kept, and plants can be rapidly propagated by layers, cuttings or budding. The same care which has been bestowed upon the rose would have made a great difference in the form of any other flower.

But the reader may say that mere form is of no consequence to the ordinary farmer. It is true that it is not as essential to his success as it is to the gardener's, but it is not a matter of indifference to the farmer. The form and color of wheat has considerable influence in fixing its market value. The same is true of corn, oats, potatoes, fruit, and nearly everything which the farmer grows. The power to change these features is worth a great deal. But these are only a part of the qualities which can be modified by skilful selection. The vigor of the plant and time of ripening the seed can be varied, and the capacity for production can be largely increased.

Each and every prominent trait of our cultivated plants may be greatly changed by careful management. It is to this fact, and the labors of many horticulturists and farmers, that we are indebted for our best varieties of grain and fruit. By making a careful selection of the materials with which he will work, the farmer may accomplish great results. We know of two farmers, each one of whom has made a great improvement of the variety of corn which he has grown for the past ten years. We know of others who have hardly been able to keep their

corn up to the original standard. The former made a wise selection of the varieties which they intended to improve. The latter were not as fortunate in their choice. MR. C. G. PRINGLE, of VERMONT, the originator of the Snowflake, Alpha and Ruby potatoes, has been very successful in improving old and originating new varieties of grain and vegetables. He is a skilful manager, and has a thorough knowledge of the habits of plants. But his success is very largely due to the wisdom with which he selected the varieties to be improved. The Champlain wheat, which he originated in 1870, was the result of a union of the valuable qualities of two varieties. He saw the need of the farmers at the extreme NORTH of a variety of wheat which should be very hardy and also be of a nice quality. There were varieties which were hardy, but of only second or third quality; while there were others which were very nice, but proved too tender for our cold winters. But in the Champlain wheat, MR. PRINGLE has secured a combination of the hardy qualities of the Black Sea wheat with the fine quality of the Golden Drop, and has produced a variety which is specially adapted to meet the wants of NORTHERN wheat-growers. Had he crossed some weak-growing variety with the Golden Drop, the new kind would have been a failure at the NORTH. But he followed the rule which all successful growers must adopt, and selected as a basis for his experiments varieties which already possessed the desired characteristics.

Plants which are to be utilized for the production of seed should be grown by themselves, and cultivated for this special purpose. This is necessary in order to guard them from the adverse influences to which they would otherwise be exposed. For if it is sown in the open field, the finest seed may not produce a good crop, and may fail to perpetuate its characteristics. In one of his lectures, HON. P. A. CHADBOURNE spoke at some length upon the modification of corn by being accidentally fertilized by imperfect specimens or by different varieties. He said

that, "The fact that seeds that look just alike, and were raised in the same place, give us much different results, is not always owing to the soil. I have no doubt that those germs are wonderfully sensitive, far beyond anything we have ever dreamed of. There are many things in our experiments that lead me to suppose this. I believe, also, that the action of this pollen is very much more far-reaching than has generally been supposed." He exhibited some specimens of corn which illustrated the liability of variation of the product of plants grown without special care to shield them from untoward influences. There were six ears—three white and three red ones—all of which grew from a white ear. The seed which produced these very diverse specimens was planted far from any other corn, so that all possibility of a mixture should be prevented. The year before the seed-corn was all white, but about half the ears which it produced were red. Sometime the white corn had, doubtless, been fertilized by pollen from a red variety grown in another field.

Probably every farmer has noticed cases in which the variety which was planted was strangely modified. Sometimes there will be an occasional ear of a totally different kind. In other cases only a few kernels of another variety will be found upon an ear which is nearly all of the ordinary sort. Sometimes a few kernels of sweet corn will be found upon an ear of some common field variety. Corn which is grown in a field which is near any other variety, will be very liable to become mixed. It will be utterly impossible to maintain the absolute purity of any variety, if a different one is planted near by. A farmer may buy the very nicest seed of the most prolific variety in the world, but if he plants it in a field which joins one in which his neighbor plants another sort, he cannot keep the variety pure. He will either be obliged to buy seed every year or else plant a mixed and inferior kind. When seed-corn is selected from the field, several neighbors should agree to plant one

variety of corn. In this way the injury from mixture which now occurs would be considerably reduced.

The habit of planting several different kinds upon one farm is not at all to be commended. It is injurious to the farmer's own interest, and makes it still more difficult than it otherwise would be for his neighbors to grow the kind which they desire to produce. The distance to which the pollen is carried is not certainly known, but it is probably greater than farmers generally suppose. We once found a bright red ear in a field of yellow corn. There was not another red ear on the farm and but few red kernels could be found on other ears. And there was no red corn grown on the adjoining farm. But beyond that was a farm upon which there was a small field of this colored variety. The red ear must have been fertilized by pollen from this distant field. There have been other strongly marked cases, and they prove that it is unsafe to rely upon the purity of seed-corn which is grown without being separated from any other kind by a much longer distance than is usually thought necessary.

In order to secure absolute purity we think a distance of at least half a mile is required. If the corn for seed is grown in a valley and other kinds are produced on the surrounding hills, this distance should be doubled.

But contact with other varieties is not the only way in which seed corn is deteriorated. If corn is grown in the open field, the pollen of the inferior stalks, and of the suckers, is just as likely to fertilize the ears as that produced by the finest specimens. An ear of corn may appear all right and yet its kernels fail to be reasonably productive, because it was fertilized by the pollen from a very poor stalk which has impressed its character upon the seed.

In almost every field, in every one of any size, which was planted with ordinary seed, there will be many small and imperfect ears. No matter how rich the land, or how thorough the cultivation which the crop receives, these specimens will appear.

They are the legitimate fruit of seed produced on ears which had been fertilized by pollen from inferior plants. In order to prevent such a result the farmer must give more attention to that part of the crop from which the seed is to be taken than is usually bestowed. The corn for seed should be planted by itself, in a field quite a distance from any other corn. If this is impossible, a plot of ground between the two pieces should be planted with broom-corn, or sugar-cane. It will be well to put a strip of broom-corn, a few rods wide, close to the field which is not to be saved, provided the fields are within eighty rods of each other. The broom-corn will hinder the free passage of the pollen, and thus diminish the liability of a mixture of different varieties or fertilization by the pollen of inferior specimens. If only a small quantity of corn is to be saved for seed, the plot on which it is planted should be in the form of a square. If a few long rows are planted, the pollen cannot be so evenly distributed as it will from several short ones. The land should be rich and the best cultivation should be given.

Another important item was mentioned by MR. CHADBOURNE in the lecture from which we have quoted. He expressed the opinion, "That in order to raise good prolific seed-corn, it will be necessary for a man to plant the best seed he can procure; and before the corn tassels, before it produces pollen, to go along the rows and cut out every mean, miserable stalk, so that every ear shall stand on a proper stalk (that is, have a proper mother) and shall be fertilized by pollen that has come from a strong, healthy, corn-producing stalk." Before the tassels form, all the suckers should be cut, and the inferior stalks removed. If these things receive attention at the proper time, the seed-corn will have a vigorous and healthy parentage. If the same course is followed year after year, a great and permanent improvement will be effected. By this means the average yield of the corn crop in this country might be greatly increased, and the profits of its production would be greater than have yet been obtained.

With the wheat crop equal care is needed in order to secure the finest seed. The best grain which is available should be sown on a rich and thoroughly prepared piece of ground. It should be sown in rows, or drilled in, far enough apart to allow the hoe to be used between them. All weeds should be kept down, and before the blossoms appear all the inferior stalks should be cut out.

With the potato crop there has been more trouble on account of poor seed than there has with almost any, perhaps we might say with almost all of the other farm crops. Varieties have "run out" in a few years wherever they were planted. Changing the seed has been resorted to by multitudes of farmers, and has given temporary relief, but no permanent good has been accomplished. The complaint is general. It has been so often made, and for so long a time, that some writers consider the deterioration as inherent in the potato itself, and recommend the introduction of new kinds, and the discarding of the older varieties when they begin to fail. We do not think this theory is correct. We are confident that by a careful selection of seed, with good culture, the varieties of potatoes may be as permanent as those of corn. We have kept the EARLY ROSE up to its original standard. There is a great deal of complaint that this variety is deteriorating. Probably the men who find it "running out" have not been very careful to select the nicest seed, and supply the best manures. Many farmers plant only the little, immature specimens which are neither fit to eat nor to sell. They seldom plant any which are even half grown. Now if corn for seed were selected in this way, there would be as much complaint about the deterioration of corn, and the "running out" of varieties, as there has been about the failure of the potato to keep up to a uniform standard of excellence. In order to obtain good potatoes for seed, the finest tubers of medium size should be planted on dry land which has been well manured. Chemical fertilizers we consider the best for

this purpose. The plants should be carefully cultivated, and when the tubers are ripe they should be dug, and the best specimens of a medium size should be selected for seed to be used the next year, and stored in a cool, dry cellar.

The different varieties of the potato should be grown in plots which are quite a distance apart. MR. WILLIAM HUNT, of CONN., read an article on the general subject of potato culture before the CONN. STATE BOARD OF AGRICULTURE, in 1877, in which he claims to have discovered the fact that the deterioration of varieties often results from their mixing by means of the flowers. He claims that the pollen is carried a considerable distance by the wind, and that where two or more kinds are grown near each other the potatoes will mix, and the product will usually be inferior to that of the parent stock. The first year the quality is not affected. The second season changes are manifest in the tubers, and in succeeding years the deterioration is rapid. This theory accounts for changes which have often been observed, but which could not be satisfactorily explained. MR. HUNT picks all the flower buds before they open, from the plots on which he grows potatoes for seed—a practice which may be safely and profitably followed by all who are engaged in producing this crop.

Such are some of the general principles which should govern in the selection of seed. We have attempted to illustrate them by reference to particular crops. With other plants the methods pursued must be modified by their condition and character. But with all crops the same careful and patient effort must be made to get the best possible grade to start with, to give it the best possible chance, and then to guard the plants from all untoward influences. After the seed is grown, there still remains a work for the cultivator in gathering and storing it. For the best seeds are just as likely to be wasted or injured by exposure as the poorest ones, and a little neglect at the time of ripening may cause the loss of nearly the whole lot. When

the plants are well-matured, and the seeds are ripe, which any observant person can easily determine by their general appearance, the harvesting should be performed. Imperfectly ripened seed will often grow, but it will not produce as hardy, vigorous plants as that which is thoroughly ripe. If the cutting of the seed-plants is too long delayed a great waste is involved by shelling in the field, and some seeds are damaged by exposure to the weather. With plants which ripen their seeds unevenly, a middle course is to be pursued. The onion belongs to this class. The heads should be removed when about half of the seed-cells have opened. Wheat, corn, and other grain, should remain until thoroughly ripe, should be carefully cured, and ought not to be shelled until it is perfectly dry. Great care should be taken, both before and after shelling, to prevent all injury by heating. The curing should be done, if possible, in bright weather, and the stalks should be stored in a cool, dry place. When thoroughly cured and dried the seed may be shelled. If it is necessary to wash it, care should be taken to dry it perfectly before it is put away.

Seeds, with a few exceptions, such as nuts, which should be kept in sand, should be kept in a cool and dry room. Putting them in papers or bags when they are damp, is one cause of the difficulty which some farmers have in getting seeds which they have raised to grow. Another cause is the keeping of seeds in a damp place, or a place which is occasionally damp. To be constantly damp will prove their ruin, while occasional moistening and drying will work equal harm. The seed should never be kept in large quantities, subjected to extremes of temperature, or allowed to become damp.

The length of time for which it will retain its vitality will vary with different kinds. Even with the best of care onion-seed is very doubtful when two years old, and worthless when three; while cucumber-seed will grow when it is from seven to ten years old. Wheat and corn will grow when they have been

kept many years. But if the seed is kept where it gets damp, its vitality is soon destroyed. It is said that squashes, cucumbers, and similar crops, are better when grown from old seed, as they will run less to vines and be more prolific. This may be true, but in our experiments in this direction we have found it difficult to get old seeds to germinate well, and have thought the plants were more tender than those from newer seed. We believe it is generally admitted that old seeds are weaker and produce less vigorous plants than fresh ones. Imperfect flower-seeds often give the finest flowers, but this is not an argument for the use of weak seeds of vegetable plants. On the contrary it is a strong argument against this course. For from the flower man desires only beauty. Utility is not considered. The increased beauty of the flower is obtained by changing the stamens and pistils into leaves. In some roses this change is complete. We now have a splendid sun-flower in our garden in which there are but a very few seeds, nearly all of the large flower being a mass of beautiful petals. Such a change makes a beautiful flower, but it would not be wise to try its effect upon vegetables. For when carried to an extreme it is ruinous to the species. Reproduction by seed becomes impossible, and it is only by means of layering, budding, or some other resource of the gardener, that the varieties can be continued. With vegetables we do not need beauty of blossom, but we are in want of a strong tendency to produce seed. And as old seed tends to the production of finer flowers at the expense of the vitality and seed-producing power of the plant, we think its use will be found unprofitable. The purest and best seeds, which are fresh and uninjured, should always be obtained for use in the garden and on the farm.

ECONOMY OF LABOR.

AS a class, farmers have obtained a high reputation for economy in the use of money. This reputation has been honestly earned. The average farmer is very careful about spending his hard-earned dollars. He does not lightly allow them to pass out of his possession. He takes a great deal of pains to obtain them and is anxious to keep them when they have been secured. But with labor the case is very different. Of this he is prodigal. He rejoices in his ability to perform a great deal of work. The average farmers in this country are very hard workers. They toil more hours than almost any other class, more hours than they require their cattle to work, and they make longer days and more of them than the men whom they hire. So far they are very faithful laborers. But they have not succeeded in systematizing their work so as to manage it to the best advantage. They are careful about their money, but very careless about their work. They lose sight of the fact that labor is a standard of value, and that the price of an article is, in a very great degree, determined by the amount of work required for its production. There are various methods in which labor is wasted on the farm. A few of the principal ones we will endeavor to point out.

The use of poor tools, or tools poorly adapted to the purpose for which they are designed, is a prolific source of waste of labor on the farm. The man who insists upon cutting his grain with the old-fashioned cradle instead of using a reaping machine for the purpose, wastes, in addition to a large quantity of grain, a great deal of labor. His horses could do more in one day than he can in many days, and do it better. He has the horses and must feed them just the same as he would have to if he had them cut the grain instead of doing it himself. He ought to have his horses do this, and in the days which they save to him he can be doing something else. The man who furnishes poor

shovels, and forks, and other tools for his hired men thereby wastes a great deal of time and labor for which he is obliged to pay. With poor tools a man cannot do as good work, or as much of it, as he can with good ones. Even good tools when poorly adapted to the purpose for which they are used involve a great loss of labor. The man who makes his team draw a heavy harrow over a field in which a light one would do just as well thereby throws away the extra labor of the team. Similar examples might be given in large numbers.

The use of inefficient teams is another way in which much labor is wasted on the farm. We have often seen two able-bodied men plowing with one slow yoke of oxen. The two men and the team would succeed in plowing one acre of land per day. One of the men with a pair of horses could have plowed an acre and a half per day while the other man might have been doing other work. Or, if it seemed desirable to use oxen instead of horses, the team might have been trained so that one man could both hold the plow and drive the cattle. We have plowed alone with oxen a great many days, and any one can do it who will properly train his teams and be gentle with them. There are places where a driver may be needed with ordinary cattle. But on smooth land one man ought to be able to hold the plow and also drive the team. Sometimes oxen which are not good to work are used and labor is wasted because they will only draw from half to three-fourths of a load at a time. When balky horses, or weak, lame animals are employed, the work is, and must be, done at a great disadvantage. With such a team economy in this branch of labor cannot be secured.

The neglect to do work at the proper time is another prolific source of waste of labor on a farm. If before the rains come, the farmer digs plenty of ditches to carry off the water, he will have much less to do to drain his field than he will if he waits until the land is soaked and then attempts to open drains. The

man who plows when the land is dry will save a great deal of labor for himself and his team. In drawing dirt there is often a loss of from one-third to more than one-half of the whole amount of labor performed. When a man draws dirt from which the water runs in streams through the cracks in his cart, he has probably got a greater weight of water in his load than he has of dirt. The water is useless material. Consequently, more than half of the labor of loading and unloading on the part of the man, and of the draft on the part of the team, is absolutely thrown away. In the cultivation of farm crops, labor is often lost by delay in attempting the work which should be promptly begun. And with many kinds of farm labor a great saving can be made by doing the work at the proper time.

Frequent changes of work are also a prominent means of wasting labor. The man who commences one kind of work in the morning, soon thinks of something else which ought to be done and changes off to that, and in the course of the day works at half a dozen different jobs, no one of which he has completed, is very wasteful of his work. He may hitch up his team many times a day to do things which might all have been done without unharnessing. The man who mows a little rowen when the dew is on, then picks a few apples, digs a few potatoes, and draws a load or two of muck to his yards, all in one day does not economize his labor. He keeps a great many things on the works at once, in all stages of development, but nothing is finished and he is always at a loss to know what to do. His constant changes involve him in a great loss of time and travel. Everything goes slowly because he tries to carry everything along at once. If he would make up his mind what work needed doing first, and then give his undivided attention to its completion, the changeable farmer would be much more economical of his labor, and, consequently, much more successful in his business.

Want of skill is one of the great difficulties with many farmers

in their efforts to economize labor. They work very much by guess. Some men are naturally much more skilful than others, but all may learn to manage farm business well. Many young farmers exhibit this want of skill. It is to be expected that they will make mistakes. Experience is a great teacher. More men have become good farmers by means of the lessons taught by experience than ever have reached success by means of any natural aptitude for the business. No one should despair because his past has not been satisfactory. Study and care will yet lead him to success. By observing how his most successful neighbors economize labor, reading the best agricultural books and papers, and studying the lessons of his own experience, he will be able to manage his business better and become, in time, a skilful farmer. The old saying, "It is half to calculate," is as applicable to farming as it is to almost anything. A well-planned effort in any line of business is the most likely to be successful. It should be one of the aims of the young farmer to learn to plan his work well. Skill in laying out work and inefficiency in executing it, sometimes, but very seldom, go together. As a rule the man who is skilful in planning will be an efficient worker.

Carelessness is one of the hindrances to economy of labor. Many farmers mean to save all their time and employ their work to the best advantage, who are careless and negligent and who are, on this account, continually incurring losses and meeting with disappointments. They forget to do things which they fully intended to perform. Very often a rainy day will come and the farmer and his hands will be almost wholly idle for want of work which can be done under cover, but in a few days it will be found necessary to do a job which might just as well have been attended to at that time and thus allowed the men to be doing other work in clear weather. Sometimes there are days in winter when certain kinds of outdoor work might be easily performed if they were thought of, but which are only

remembered when the opportunity has passed away. Then, in the hurrying days of spring, time has to be taken to do what might just as well have been done when there was nothing else on hand. Besides, it often happens that by delay the amount of work required is largely increased.

Failure to economize labor often results from the performance of unnecessary work or the doing of ordinary work in too elaborate a manner. One of the kings of MACEDON spent many years of his life in making lanterns. The important interests of his kingdom were neglected because he was too busy to attend to them. He was not an idle man, but his work amounted to nothing because he wasted his labor. Many farmers spend a great deal of time and labor in doing work which will prove of no benefit to themselves or to any one else. There are also many who are very particular about their methods of doing work. They hoe their potatoes as carefully as a mason builds a wall. Their corn might be cultivated just as well, as far as the good of the crop is concerned, by horse power, but they will have every hill nicely hoed by hand two or three times during the season. We dislike to see work slighted, and never advise running over it, but the great fact that labor costs and that the man who wastes labor thereby wastes money, ought to be kept constantly in mind and should prevent that extreme nicety in the performance of farm work which requires much extra time but yields no corresponding return.

Another reason why so many farmers fail to economize labor is to be found in the fact that their buildings are very inconvenient and their farms are poorly laid out. The amount of extra work required on a farm which is not well arranged and has inconvenient buildings is very great. One farmer will grow his green fodder crops near the yard in which he feeds them, while another will put them far off in the field. All through the months when this kind of fodder is needed, one of these farmers will simply cut and throw into the yard what is wanted at once,

spending only a few minutes about the work, while the other will be obliged to hitch up a team, drive into the field, and be gone quite a length of time. One man will have his yards so arranged that when his team draws a load of manure into the field, a load of muck can be brought back. Another man has his yards so laid out that the manure must be carted out before material for compost can be brought in. Some farmers have convenient places of storage for all their crops and tools, while others are constantly cramped for room. On some farms the buildings are so inconveniently arranged that the work of doing the chores in winter is just about doubled. On other farms everything is convenient and work can be rapidly performed. It will pay well to study convenience in the arrangement of fields and buildings, and even to be to some expense to secure it. The man who has things "handy" will get along faster, better, and easier, with his work than the one who is constantly hampered by inconvenient surroundings.

There are many other ways in which economy of labor can be secured, but as we must limit our attention to general principles, with illustrations thereof, we will not pursue the subject further. We will only remark that as the excessive spending of money for needless purposes is ruinous, so the waste of labor which is so common in all parts of the country is proving a great and constant burden. The honest farmer must work hard. From this necessity there is no exemption. When he obtains a suitable reward he can labor with a cheerful spirit, but to work hard and be constantly unsuccessful is very disheartening. By carefully economizing his work the average farmer can secure a very gratifying degree of success. Without this careful saving of labor and time, he will be almost certain to fall far below his hopes and expectations.

FARM TEAMS.

A TEAM, of some kind, every farmer must have. He cannot do his work without one, and neither borrowing nor hiring can be depended upon to furnish one just when its services are required.

The principal animals used in this country for teams are the horse, mule, and ox. For many places and purposes the horse is much the best. The mule is hardy, long-lived, and can be easily kept, but for various reasons he has not become as popular as the horse. There are places where neither horses nor mules can work to good advantage, but in which oxen can be profitably employed. But on the road oxen are very slow, and cannot successfully compete with either horses or mules.

Which of these animals it will be best for the farmer to keep for a team must depend upon his circumstances and the character of his land. On some farms oxen would be wholly inefficient, while on others they would be the most profitable animals for a team which the farmer could employ. For most purposes either the horse or the mule-team is better than an ox-team. But it does not follow that every farmer ought to keep horses or mules. A steam-plow is better than a horse-plow, but not every farmer can have one. It is faster and pleasanter travelling on the cars than it is on foot, but many people are obliged to walk because they cannot afford to buy tickets of the railroad companies. There are farmers who would like to use horses or mules, but who are under a sort of necessity to keep oxen because they cannot afford a better team. Still, there are many who prefer pleasure to profit, and who keep horses although oxen could do their work at a much less expense. In NEW ENGLAND there has been a great change in this direction. Twenty years ago oxen were extensively used, but they have been, to a very great extent, superseded by

horses. Some farmers have found the change profitable, but many have lost money by the operation. The horses make a better team, but many of these farmers could have got along with oxen, and saved quite a sum both in the first cost of the teams and in the expense of keeping them. If teaming were the only kind of work to be done on a farm either horses or mules would be needed. Oxen would require more time than the farmer could afford to give. But on many small farms the team is not constantly employed, and oxen could do the work.

In the great grain-growing sections horses or mules will be absolutely needed. It is of great importance to get the land fitted, and seed sown at the proper time, and delay, though only of a few days, will involve a heavy loss. Oxen are too slow for use in such places, and for work on the road. On farms where grain-growing is not a specialty, the owners may be better able to furnish the extra time required to work with oxen than they are to pay the higher price which a better team will command. There are a few places in which oxen are the best team. On steep hillsides, and in the mud, they are decidedly superior. But for most purposes horses or mules are greatly to be preferred.

On the one hand there is the greater degree of efficiency of the horse and mule, while on the other there is the lower price of the ox. The cost of keeping and shoeing a horse or mule-team is much in excess of that required for the ox-team. Then, too, the horse and the mule rapidly decrease in value until old age renders them worthless, while the ox depreciates but little for several years, and at any time can be fattened and sold to the butcher for almost, if not quite, as much as he was ever worth. If a horse or mule is accidentally injured, a part, and often the whole, of its value is thereby destroyed, but if an ox gets lame he can be fattened and but little loss will be sustained.

The expense of fitting out a horse or mule-team is much greater than that required for an ox-team. The harnesses and

wagons required for the former costs a great deal when compared with the yoke, chains, and cart, which are needed for the oxen. Whether the extra time required in using the oxen is worth as much to the farmer as the extra cost of a horse or mule-team, the increased expense of keeping, the higher cost of wagons and harnesses, depreciation in the value of the horse or mule-teams, and the interest on the extra amount of capital thus invested, is a question to be considered by those whose farm-work oxen are qualified to perform. We do not, except for purposes already indicated, recommend oxen as a better team than horses or mules, but merely raise the question whether in many cases they may not be less expensive.

The farmer must keep one horse, or mule, for use on the road. He cannot get along without it, although if the farm-business is small there will be a great deal of time in which it will have nothing to do. If by obtaining one more horse, or mule, he can perform all the farm-work with the pair, it may be better to keep the extra one than it is to buy a yoke of oxen.

On large farms several animals must be kept for work. There should be a sufficient number to do the work promptly and thoroughly, but the temptation to keep more horses or mules than are needed should be resisted. Every idle horse or mule involves its owner in a great expense. It costs almost as much to keep one idle as it does at work. In one case the expense is paid by labor, while in the other there is no return. A good team, fully able to do all the work and do it well, should be kept on every farm, but it will not pay the owner to keep a larger number of animals for this purpose than are really needed for its accomplishment.

FARM FENCES.

NO quite an extent farm fences are necessary. There must be a fence around the pasture; there should be a fence on the boundary line of the farm, except where it joins the highway; and if cattle are allowed in the mowings in the fall, it will be useful to have the grass-land divided into two or more fields. It is also well to have fences so that cattle can be kept off the grain fields when they would be liable to track the land and injure the crop. But it is not necessary, and it is not desirable, that the whole farm should be cut up into eight or ten-acre fields, according to the practice of some of the NEW ENGLAND farmers of a former generation. Such a course involves an immense cost for fencing, and a great waste of land. The cost of the fences now standing in this country is far beyond the estimate which a man not acquainted with the facts would make. We know of farms which are cut up into small fields by heavy stone walls. The work of gathering the stones and building the walls could not now be hired for the whole value of the land and crops and buildings. There are thousands of farms in NEW ENGLAND which will not sell for enough to pay fair day's wages for the work which has been done in fencing them. It has been asserted that the fences in this country cost more than all of the houses, including those in cities; more than all manufactories with their machinery; and more than any other single class of property, except real estate. The annual cost of fences, including interest on the investment, is said to be from one to two hundred millions of dollars. Whether these estimates are accepted as exact or not the great fact that a vast amount of money is already invested in fences remains beyond dispute. It is equally evident that a large number of these fences are wholly useless.

On account of the great expense and the loss of land involved in their construction, we do not favor having as many fences as

are usually found on the farm. The fences we have named seem to be necessary. Others would often be convenient, but would cost more than they would be worth. In many cases a temporary fence can be employed, which will give the conveniences without the disadvantages of a permanent structure. In some of the States it will also be necessary to fence next the highway, or else endure all the losses which may be sustained by droves of cattle or by stray animals. In MASSACHUSETTS the law does not require roadside fences, and within the past five years a great many of the old walls and the board fences, together with some of the more pretentious slat, or picket fences, have been removed. The appearance of the farms, and also of the towns, has been greatly improved by this change, and a great saving is effected by the owners of the land.

The kinds of fence in common use are the rail, the post and rail, post and board, stone wall, hedge, embankment and wire fence. The common rail fence is open to the objections of requiring a great deal of timber, occupying a great deal of land, and of being easily thrown down. There are various modifications of this style of fence, and where land is plenty, timber cheap, saw-mills scarce, and money does not abound, some of these forms may be profitably employed. But as a rule, under ordinary circumstances, and especially where land is valuable, some other style will be more desirable.

The post and rail fence is an improvement on the style already described, though subject to some disadvantages. For this fence much less timber is needed, and it occupies less than half the land which the other requires. It is also a more substantial fence. But the work of digging the post holes, cutting the holes in the posts to admit the ends of the rails, and of fitting the rails, renders the labor item quite expensive. On land which is inclined to heave, the posts are soon thrown out unless they are filled around with gravel, or some other precaution is taken to prevent the evil. If a large hole is dug, and a

piece of board two feet long is nailed to one side, near the bottom, and another piece on the opposite side a little higher up, and the earth firmly packed down, the post will rise and fall with the soil, and will not be thrown out. Such a fence, if well built, will last many years without repairs.

The post and board fence looks better than the post and rail. In some sections it is cheaper, while in others it is more expensive. Posts seven feet apart, with four six-inch boards placed six inches apart and firmly nailed, make a good fence. This style requires but little land and very few repairs.

The stone wall is a very common fence in NEW ENGLAND, and is used to some extent in other sections. When well made it is quite durable, and will turn cattle and horses, but will not keep sheep without a rail, or something of the kind, placed on top. It takes considerable land, and makes an almost immovable fence. No matter how much a farmer may want to change the size of his fields, if his land is cut up into little lots divided by heavy stone walls, he must leave them as they are, or else be content to perform an immense amount of work. On very stony farms it may pay to make the boundary fences of stones. This, not because it will be a cheap style, but merely in order to find a place to put the stones. The inside fences of a farm should be made of lighter material which can be more easily removed.

Live fences have attracted much attention, and been extensively introduced at the WEST. In NEW ENGLAND there are also many hedges. We do not like these fences, but it may sometimes be well to make a virtue of necessity, and use them for want of anything better adapted to the circumstances of the farmer. Our own experience has been with a species of the willow brought from OHIO, and very highly recommended. It makes a strong fence, but, being a vigorous grower, requires much trimming, it looks badly, and takes a great deal of plant-food from the land. Many farmers have used the buckthorn,

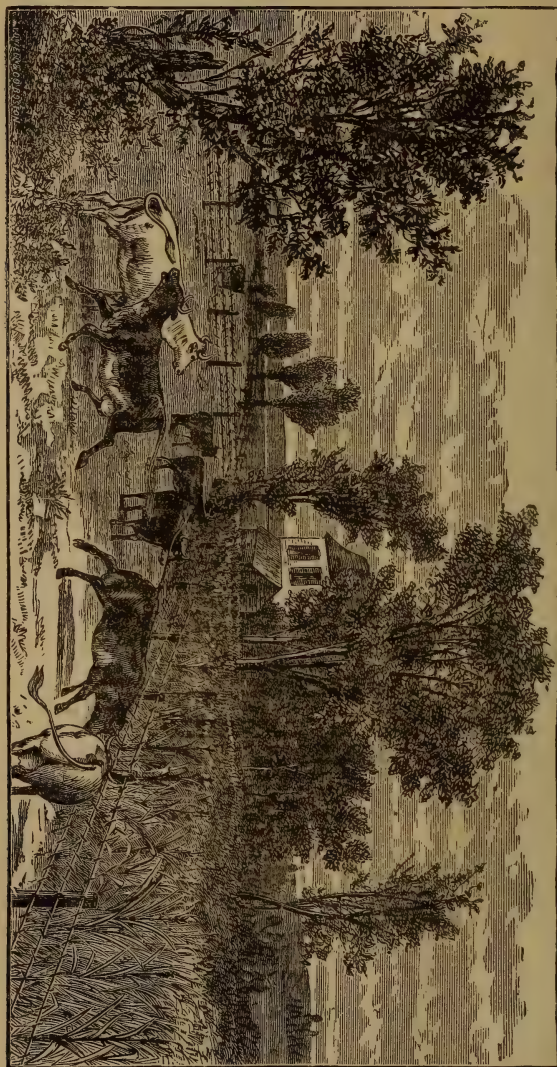
arbor-vitæ, hemlock, and pine. Each of these will make quite a fence, but they require manure and cultivation to insure a strong and uniform growth when young, and much pruning to make them look decently when they have attained considerable size. They are also subject to the adverse influences of extreme drought and severe cold. As they cannot be removed without being destroyed, they are not well adapted for inside fences, while if neighbors choose to quarrel they may cut the roots upon their own sides, and thus injure the boundary-hedges. In the MIDDLE and SOUTHERN States the Osage orange is a better hedge-plant than those we have named, but it will not endure NORTHERN winters. The honey locust is one of the best hedge-plants for all sections.

Embankments are often used in ENGLAND for fencing between two farms. A large, open ditch is dug on the line, and the dirt piled up in a high wall upon one side. Of these fences LOUDON says the earth taken out is "formed into a bank, the height of which when added to the depth of the ditch forms a tolerable barrier." But he does not recommend them as highly as he does 'the double ditch, in which the earth from an open ditch on each side is piled upon the line of the fence, and a hedge is planted on top of this embankment. Where the land is very wet, and underdraining is impracticable, one of these methods may be adopted. We recommend it only for very wet land, and consider its value as an instrument of drainage to be far in excess of its merits as a fence.

The wire fence is now quite popular, and seems destined to come into extensive use in all parts of the country. Some years ago plain wire was used at the WEST for fencing purposes. It possessed many merits, but was defective in some important respects. Various improvements have been effected and patented. The most important of these have been bought by the WASHBURN & MOEN MANUFACTURING CO., of WORCESTER, MASS., and united in the GLIDDEN STEEL BARB FENCE. This

fence possesses many advantages over any other style. The wire is very strong, being made of two strands, and will sustain a weight of fourteen hundred pounds to each line. It is easily

FIG. 51.—BARB WIRE FENCE



seen, and, having many barbs, cattle find it impassable. When once well put up it remains in place through all extremes of heat and cold. This wire makes a very cheap fence. Four

lines can be put up at a cost for materials of only seventy-five cents to one dollar per rod, and make a fence through which no animals, large or small, can pass. The barb wire fence is represented in Figure 51. Such a fence can be put up very rapidly, will not be destroyed by prairie fires, will not be blown down, and will neither cause drifts nor be injured by snow. This wire can be used in connection with old or new wood fences if desired. We have tried stretching one line on top of an old VIRGINIA fence which the cattle often used to throw down. It has worked to perfection, and made the old fence safe at a very slight expense. This wire is well adapted for use as a temporary fence for keeping cattle out of grain fields in the fall. For this purpose posts can be set quite a distance apart, and only two, or, at most, three lines of wire will be needed.

In making a fence which is designed to remain for any length of time it is best to use good materials and do the work well. For a VIRGINIA fence wooden blocks will prove much better than stones for foundations for the corners. The former will decay in time and must be replaced. The latter will last, but will soon sink into the ground and become useless. Stakes should be made long enough to be re-sharpened and used again when the ends in the ground decay. They should also be large enough to keep the fence in place. From rails, stakes, posts, and boards, all the bark should be taken before they are put into the fence. When the bark remains the timber will last but little, if any, more than half as long as it would if the bark had been taken off. Sound timber should always be chosen, and when a post and board fence is made, heavy nails should be used. It does not pay to have too many fences, but it is best when making one designed to be permanent to use good materials and put them together in the best possible manner.

FARM ROADS.

FARM ROADS are a great convenience, though not an absolute necessity. Many farmers have nothing of the kind. They drive all over the fields, wherever they want to go, and make no effort to secure a good road in any part of the farm. The result is that their mowing lots and grain fields are cut up with wheel tracks and trodden by the team, the labor of drawing the loads is increased to such an extent that the teams are obliged to work extremely hard, while the work is so severe, especially when the land is softened by rains, that much smaller loads must be taken than could be drawn if good roads were provided.

Roads will cost some labor, but in the end will save both labor and time. The farmer and his help can easily make them. On every farm there should be one good road which, with its branches, shall lead from the barn to each field.

On dry land the farm road is easily constructed. Many farmers rely merely upon a cart path. But such a path soon becomes rutted. Very little grass will grow between the tracks, and the land had better be devoted wholly to the purposes of a road. The ruts cause the loads to draw very much harder than they would on a good road, while they are also liable to cause wagon wheels to be unduly wrenched and twisted. A team will draw a heavier load on a good road than it can in the ordinary cart path, and wagon and cart wheels will last much longer—advantages which will soon compensate the farmer for the labor required in making the road.

The farm road should be elevated a little above the level of the land, and in order to let the water run off it should be made a little higher in the middle than it is at the sides. The ground should be plowed, graded, and rolled. If it is nearly level, an open furrow may be left on each side. Where the land is wet the labor will be increased. The ground should be thor-

oughly underdrained. If stones are plenty, the earth may be thrown out to a depth of two or three feet and the trench filled with cobbles, upon which the dirt may be placed. The centre of the road must be some higher than the edges, and at the sides an open furrow, or a trench filled with stones, should be made. If there are no stones to be had, tiles may be laid under the road. When this course is impracticable, the road should be considerably elevated and large ditches at the sides should be made to take off the water.

In some places several farmers could profitably unite in buying a machine for making roads. The cost to each would be slight, while all the advantages of single ownership would be secured. The Champion Road Grader, made by the Eureka Manufacturing Company, of Rock Falls, Ill., is an excellent implement for making farm roads.

It may be objected to farm roads that they will be in the way when the fields are plowed. This has little force, for the roads can easily be avoided. They will often prove very useful. Many a load of hay has been shaken off while being drawn over a rough cart path which would have stayed on, and all the labor of reloading, with its loss of time, would have been avoided if there had been a good road where it was drawn. A man and team carting out manure in the wet weather of spring will accomplish a great deal more if there is a good road than they can with only a common path to draw it over. On a good road the team will draw as much at twice as can be taken at three times in a cart path on soft land. The use of poor roads thus involves a loss of the time and labor of one day out of every three in which the team is used.

Not only this, but the liability of accident is greatly increased by poor roads, or by driving in the ruts where no roads are provided. Many a horse has been made lame for life by injuries received while drawing loads in a muddy cart path. Thus the horse is obliged to endure a great deal of suffering, while the

owner must sustain quite a loss. If a good road had been furnished, both of these evils would have been avoided.

The loss of labor is another consideration which should have considerable influence in inducing the farmer to keep good roads. We have already shown that labor is equivalent to money. And it is easy to see that there is not only a great loss of time involved by using poor roads, but also a great deal of labor. The team may be required to draw only two-thirds as much on a poor road as it would have to take on a good one, but the labor is greater than it would be with a full load. This increase is not merely in the aggregate amount of work, in the necessity of working three days to do two days' labor, but each and every load, though only two-thirds as large, draws much harder than a full load should.

On dry land it will pay to furnish good roads for the team, while on wet land a heavy and constant loss will be incurred by the farmer who uses a cart path, or drives where he happens to, instead of making a good road over which loads can be easily drawn.

TIMBER CULTURE.

THE setting of timber trees has often been recommended and in many places can be made quite profitable. The WESTERN farmer needs wood for fuel, and timber for building and fencing purposes. His house should have trees around it to purify the air, and his cattle need shade in their pastures. In NEW ENGLAND there are many farms upon which trees are needed for these purposes, and many tracts of comparatively waste land which can be made useful by their production. At the SOUTH there are many places where trees would improve the land, make the locations more healthful, and supply a great want of nice timber.

In all sections of the country there are a multitude of farmers

who, by devoting an acre or more of land to the growth of the finest timber trees which flourish in their localities, could greatly increase the value of their farms and do a good thing for the financial interests of their descendants. Some varieties of trees grow very rapidly, and with a little cultivation the slow-growing sorts can be hastened in their development. Even on land which is far from good, timber culture often proves quite profitable. MR. J. S. FAY, of MASS., devoted one hundred and twenty-five acres of very poor land to timber culture in 1853 and a few succeeding years. Larch trees transplanted from the nursery in 1853 were forty feet in height, and ten or twelve inches in diameter a foot above the ground, in 1875. Other varieties of trees also made a very rapid growth. About three-fourths of the trees were obtained from seed sown where they were to stand, some were imported, while others were started in the nursery. Probably at the WEST the growth of timber trees would be much more rapid than it is at the EAST.

For growing at the WEST and SOUTH the catalpa is a splendid tree. It grows very rapidly and the wood is one of the most durable kinds known. MR. SUEL FOSTER, of IOWA, says there are two varieties, one of which occasionally winter-kills at the NORTH, while the other seems to be as hardy as the maple or oak. We know of a few trees in MASS. which when small were somewhat affected by severe winters. Probably the hardy sort would do well in all parts of the country. This tree grows so rapidly that it soon becomes large enough for bean poles, and in six or eight years will do for fence stakes and many other purposes. The trees are healthy and not liable to be attacked by insects. For railroad ties, bridges, fences, and other purposes for which permanence is required, this timber is of great value. It also takes a fine polish and is useful for cabinet work and finishing the interior of buildings.

There are many other varieties of trees which grow rapidly and succeed in large sections of the country. The white ash,

walnut, EUROPEAN larch, locust, chestnut, and pine can be easily and successfully cultivated in most of the States. The white oak is also a very valuable timber tree and will adapt itself to a wide range of soil and climate, but is of a slow habit of growth. A few trees of this sort might well find a place in a timber plantation.

It is better to set several different kinds of trees than to use only one variety. These trees may be started from seed planted where they are to grow, from seed in the garden and the trees transplanted when three or four years old, or they may be obtained directly from a nursery. We think it is decidedly better to follow either of the other plans than it is to plant the seeds where the trees are expected to stand. The distance apart at which the trees should be placed will depend upon the purposes for which they are to be used and the size which they are expected to attain.

It has often been asserted that the removal of forests greatly diminishes the rain-fall, affects the climate unfavorably, and injures the soil. On the other hand, the claim has been made that when taken in periods of twenty years the rain-fall is nearly uniform, that it is not changed to any extent by the presence or the removal of forests, and that the changes of climate and soil which have been observed in connection with the clearing off of vast forests are due to other causes.

It is probably true that the average rain-fall of a country in periods of twenty years is about the same, but when quite a proportion of the land is well covered with trees the rain is much more evenly divided than it is when there are no forests. If the land is bare, a large part of the rain falls in heavy storms and runs into the rivers and seas without proving of much use in watering the land. But when there are plenty of forests the clouds are frequently intercepted, rain falls often, and, coming in small quantities, refreshes the earth and keeps it from becoming parched. In this way forests prevent both floods and

droughts. Forests must also exert quite a modifying influence upon the climate of a country. They break the force of the cold winds which prevail in winter and cool the hot ones which blow in summer.

By these modifications of the rain-fall and climate it will be seen that the clearing off of large forests must unfavorably affect the soil. The removal of large bodies of timber dries up the little mountain streams, breaks the uniformity of the rain-fall, makes the planting seasons late and cold and the summers hot and dry. The maintaining of a proper balance between the area in forests and under cultivation seems to be one of the important conditions upon which the highest success in agriculture depends.

Another important matter connected with this subject is the influence of the changes wrought by the removal of forests upon the health of the people. The changes of temperature become more sudden and violent, and invalids find the climate increasing in severity. Trees are also needed to purify the air. They should not be so close to buildings as to prevent the shining of the sun upon them, but they ought not to be very far removed. There are places in ITALY which were once very pleasant and healthful localities, which after the removal of the surrounding forests gradually became unhealthy, and at certain seasons of the year were considered unsafe. In some of these localities trees have been planted, and the original purity of the atmosphere has been secured. Doubtless there are many places in this country which would have been healthful instead of malarious, if the forests had been preserved.

Timber culture offers to a large class of farmers a field of profitable labor. By growing timber trees in sections destitute of wood, or by carefully selecting from the forests which remain the specimens which have matured and keeping the young and vigorous ones for future use, the farmer may secure for himself and for those who come after him a great and permanent benefit.

POWER ON THE FARM.

THERE are many purposes for which power is needed on a large farm, and it is often very convenient on a small one. The principal kinds which are adapted to the purpose are horse-power, wind and steam. Water-power is useful where it can be obtained, but on most farms this is out of the question. For light purposes, such as churning, dog or sheep-power is often used. As horses are kept on all large farms, their services are very often employed. Wind is

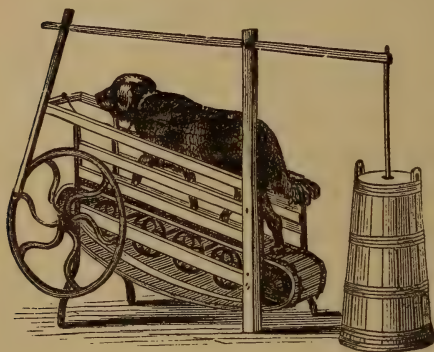


FIG. 52.—DOG-POWER.—MADE BY N. Y. PLOW CO., N. Y. CITY.

also used to quite an extent, and a few of the largest farmers are making some use of steam. But the majority of farmers who use power must choose between that of the horse and the wind. The object to be attained is the substitution of the cheap power of horses or wind for the more costly labor of men.

Each of these kinds of power has its advantages. Horse-power is movable, and can be set up and used at home or abroad. It can be readily attached to the various machines which it is desired to use. It can be easily regulated, and used whenever it is wanted. The cost is also within the means of a large class of our successful farmers. Wind is a variable power—sometimes altogether too strong, while at others it accomplishes nothing. A wind-engine once erected is stationary, and must remain where it is placed. As its location is usually on top of a building, or a high tower, it cannot be so readily attached to the various machines to which its motion is to be communicated as the horse-power. But while the horse-power has some-

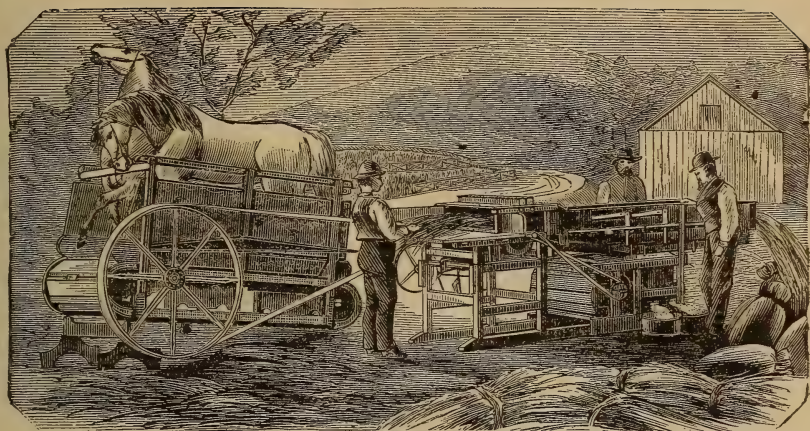


FIG. 53.—HORSE-POWER. MANUFACTURED BY A. W. GRAY'S SONS, MIDDLETOWN SPRINGS, VT.

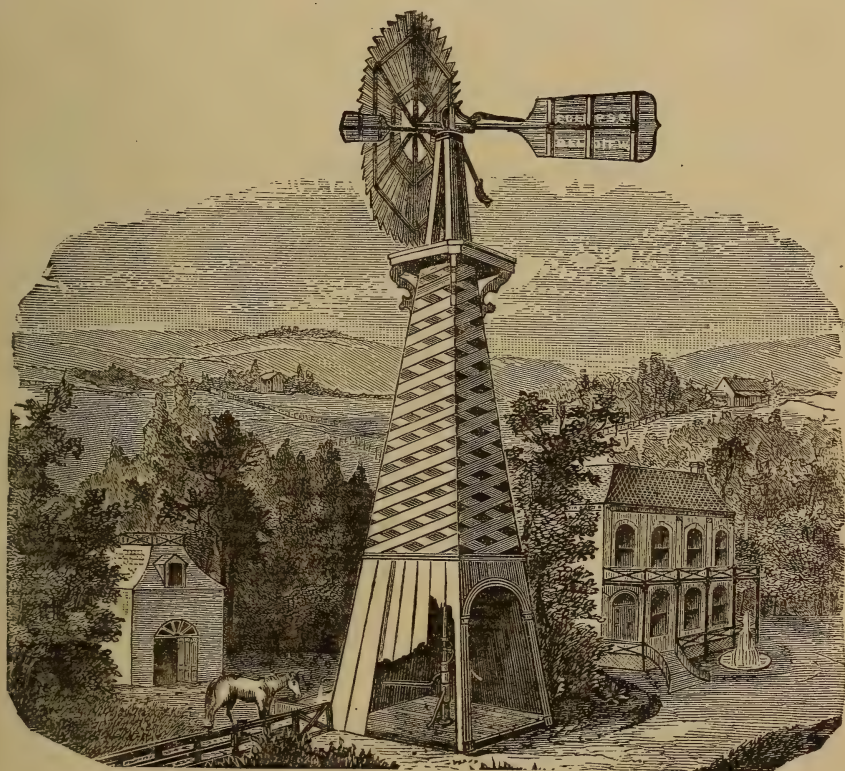


FIG. 54.—WIND-MILL. MANUFACTURED BY ECLIPSE WIND-MILL CO., BELOIT, WIS.

advantages over wind, the latter also has some points in which it is superior. For pumping water in distant pastures it is the only available power. The farmer can neither go with, nor send his horse-power there to pump water, and if he could the expense would be greater than that of erecting a wind-mill. By the use of suitable tanks, a supply can be provided for calms; and by means of an automatic arrangement, the pump will cease to operate when these tanks are full, and begin again when they are empty. Many farmers have used wind-mills for pumping water in their pastures, and found them very profitable.

For the other purposes to which power is applied on the farm, the wind-engine should be near the barn. A good one may be used for shelling corn, threshing grain, grinding feed, and sawing wood. A light wind will be sufficient to drive it, and the inconveniences attending the use of this power can be offset by the low cost for which it can be supplied. The mechanical part of the horse-power is not very costly, but the power itself must be furnished by horses at a considerable expense to the owner. It is true that horses must be kept on the farm for other purposes, and that they can often be driving machinery when they would otherwise be idle. But the more the labor of the team is increased, the greater will be the cost of keeping, the liability of accident or disease, and the sooner the animals will be worn out. Many farmers who have other work enough for their horses prefer to use wind as a power rather than keep a larger team. Others have horses enough to do all the farm work, including the driving of the machines which they need to use. Consequently, some will find it profitable to use wind-mills while others will prefer the horse-power.

A very good stationary steam-engine for farm purposes can be had for a comparatively low price, and in sections where fuel is abundant steam may be largely used as a motive power for driving farm machines. The use of steam will require buildings

specially adapted to the purpose, and the employment of careful help or else the personal attention of the owner. A good wind-engine, properly arranged, will pretty much take care of itself. Horse-power ought to have a careful manager, but careless handling does not involve as much danger as it would with steam. The engines may be made nearly self-regulating so as to avoid great liability of explosions, but if the manager is careless the machine may be ruined and a heavy loss involved. But, in spite of some drawbacks, steam gives certain advantages which can be secured by no other power adapted to the farm. By a little additional expense the food for the cattle may be steamed and roots can be cooked, if desired. Probably any intelligent farmer who once makes a practical trial of steam-power, if he gets a good engine, will be perfectly satisfied with its operation. Some of the portable engines also give promise of still greater usefulness.

A few words may be admissible concerning steam-power as a means of performing the heavy work which usually devolves upon teams. It is generally known that in ENGLAND steam-engines are very often used to draw the plow, but perhaps many farmers are not aware that steam-plowing has been successfully employed at the SOUTH, WEST and in the MIDDLE STATES of our own country. We do not refer to mere experiments, but to the practical operations of the steam-plow. The great seedsmen, D. LANDRETH & SONS, of PHILADELPHIA, have used steam-power with gratifying success in the culture of their large farms. Engines are being simplified and improved, and it may be confidently expected that before many years shall pass the great prairies of the WEST will be thoroughly tilled to a great depth by steam. The engines for drawing the gang of plows will also be effective for other farm work. Such engines will not be used by the smaller farmers on account of their expense, but there are many large land-holders who will be able to cultivate their farms at a less cost by the use of steam

than they can with horses. At the SOUTH, on account of the difficulty of securing labor, the steam-engine will probably become a great reliance of the progressive farmer.

In many places the plan of neighborhood ownership may be profitably adopted. Several farmers living near together, and each doing too small an amount of business to justify the



FIG. 55.—PORTABLE ENGINE, MADE BY BLYMYER MFG. CO., CINCINNATI, O.

expense of separate machines, could purchase a horse-power, or steam-engine, in company, and thus, at a very moderate cost, secure nearly all of the advantages of individual possession.

There are many different styles of horse-powers, wind, and steam-engines. The illustrations which we give represent standard machines.

FARM IMPLEMENTS.

WITHIN the past thirty years machines have largely taken the place of hand-labor on the farm. By their aid the work can be performed much faster, and some kinds much better, than it can be done by hand. As they enable a man with a small amount of capital to do a much larger business than he could carry on without them, and also prevent a great deal of waste which would otherwise occur, they are usually considered both cheaper and better than hand-power. To the small farmer they are a great convenience, while the large farmer finds them indispensable.

The machines which the average farmer needs are divided into several classes, those of each class being fitted for the performance of

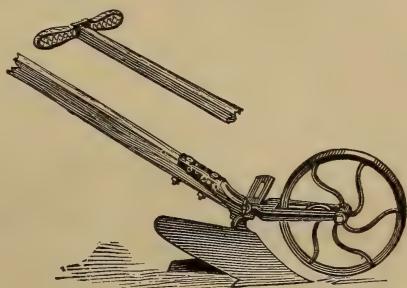


FIG. 56.—FIREFLY HAND-HOE.

some special line of work. One class is designed to prepare the land to receive the seed, another for seeding, one for the cultivation of crops, another for harvesting, and still another for preparing the products of the farm for use or for the market. Other machines are used because by their aid work can be done more conveniently than it can by hand, while household implements form a class by themselves. We have already described and illustrated many of these machines, but some classes deserve somewhat fuller treatment.

THE PLOW is one of the most important implements for preparing the land to receive the seed. It is made in many different forms, and of various kinds of material. To attempt to say which is the best plow in use would be a foolish effort. Some plows are better for some kinds of work than others, while for other work they are inferior. The buyer should obtain a

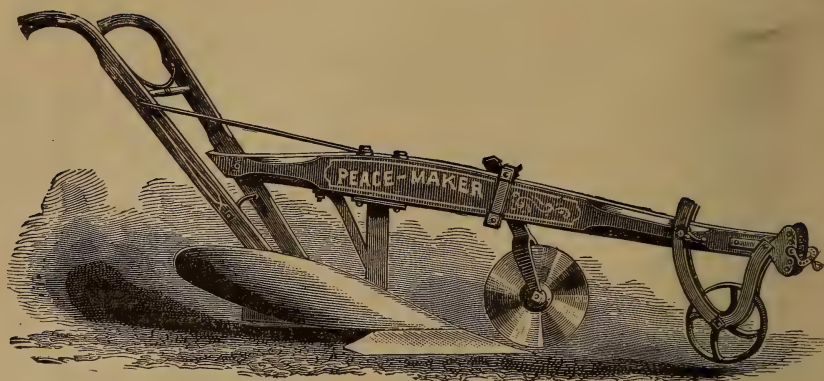


FIG. 57.

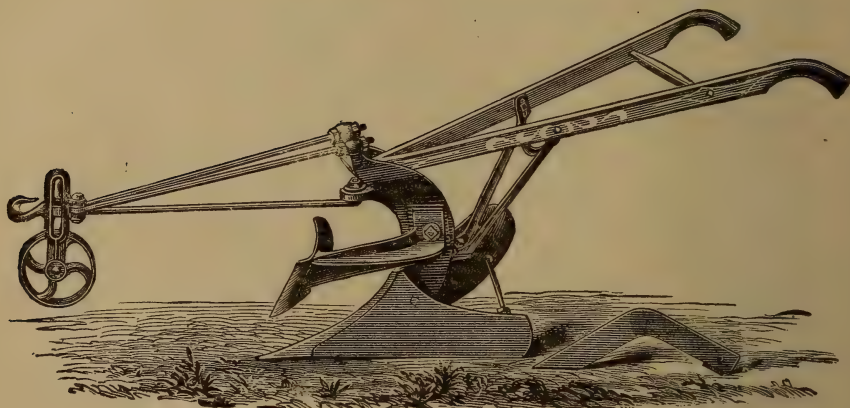


FIG. 58.—GALE CHILLED PLOW.

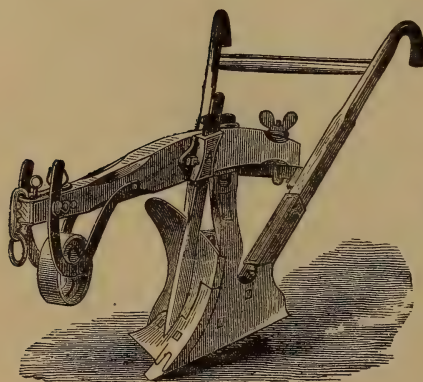


FIG. 59.—ADAMANT PLOW.

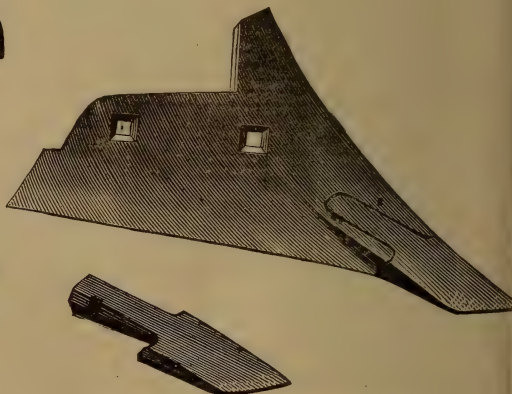


FIG. 60.—SLIP-POINT.

plow which is suited to the work which he designs to perform. It is not wise to attempt to do light work with a heavy plow which was made to run deep, nor to try to turn wide, deep furrows with a small, light plow. The strength of the team ought also to be taken into consideration.

Whether iron or steel plows should be used will depend somewhat upon the kind of land which is to be plowed. Iron is generally preferred in very stony fields and many farmers like it

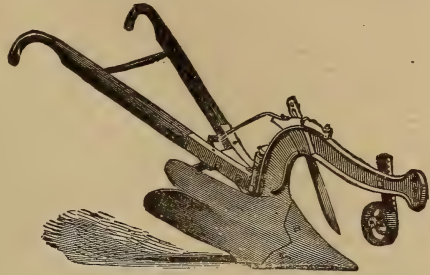


FIG. 61.—ONEONTA CLIPPER.

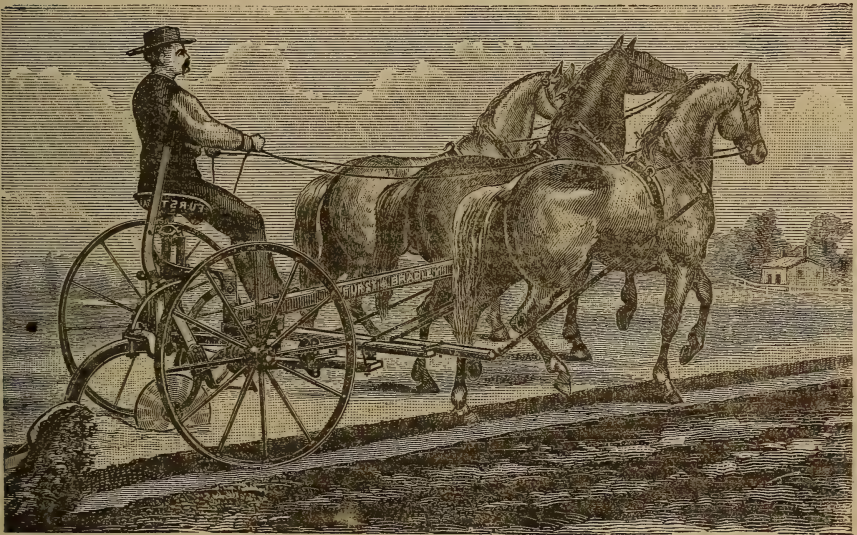


FIG. 62.—SULKY PLOW.

better for all work except turning very sticky soils. With reasonable usage a steel plow will work successfully where there are many stones. We have used one several years where the fields were quite stony. Also in very soft, mucky soil. For the latter the steel plow is incomparably better than iron. For ordinary land a first-class iron plow will give satisfac-

tion if it is adapted to the work required of it and is well used. The same is true of the steel plow with the additional advantage of lasting longer, and of being able to work in all kinds of soil which are not extremely rocky, but it has the disadvantage of a somewhat higher price. The "chilled" plows are also very good and durable. Sulky plows are extensively used at the WEST, and with sufficient power will do perfect work with great ease to the operator.

Each farmer ought to have at least three different styles of plow, and one doing a large business may need several more. The small farmer should have a sod-plow, a stubble-plow, and a light one-horse plow for the marking out of land for planting, for covering potatoes, and the various other purposes for which such an implement is almost indispensable. It does not pay to try to get along with two plows when three are absolutely needed.

As the yield of the crop will depend in a great measure upon the thoroughness with which the land is plowed, it follows that a perfect working plow should always be secured. It is not an object to buy inferior plows, either of pattern, material, or construction. If the plow is not of good form it either will not do good work, or else it will require too much power to draw it. These are radical defects, and should always be avoided. If a plow is made of poor material it will very soon wear out, and though such plows may be cheap to begin with, they are the most expensive of all in the end. Better pay twenty dollars for a plow made of good material than buy one made out of poor stock for fifteen. The former will last a long time. The latter will be likely to fail very soon, and may give out at the most hurrying time of the whole year, when each day's delay while waiting for a new one will prove a great damage. In the end the cash expense of such plows will far exceed that of the better and higher-priced ones, while the inconvenience and delays which will be inevitable will add still more to their cost.

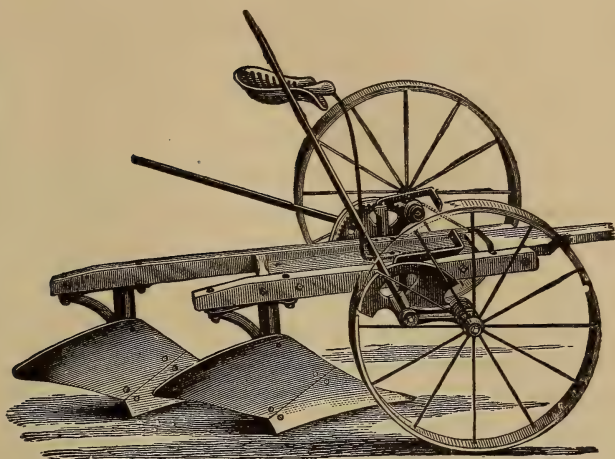


FIG. 63.—COLLINS STEEL GANG PLOW.

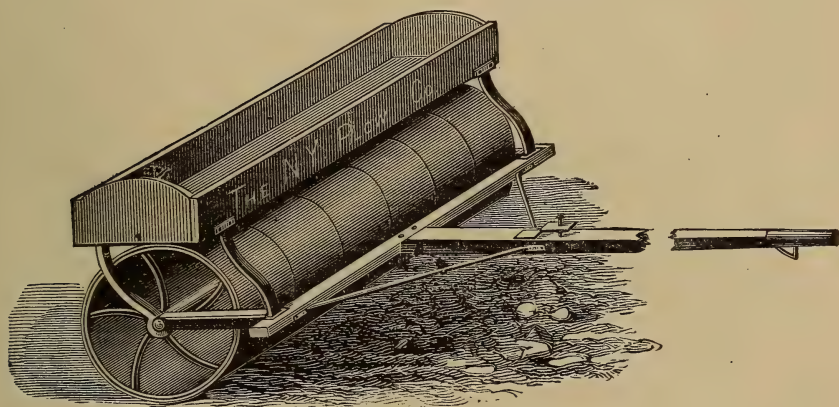


FIG. 64.

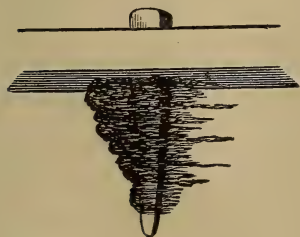


FIG. 65.—CLOGGED-HARROW
TOOTH.



FIG. 66.—THOMAS SMOOTHING HARROW.

If the plow is poorly made, a defect which is often, but not always, associated with the use of poor materials, there will be constant danger of breakage, liability of delays, and heavy expenses for repairs. It is always best to obtain plows of good form, which are made of good materials and well put together. We present illustrations of several standard plows. Figure 56 represents a plow, or hoe, for hand-use in the garden. It is made by S. L. Allen & Co., of Philadelphia, Pa. Figure 57 shows a large plow for breaking heavy sod. It is made by the Furst and Bradley Manufacturing Co., Chicago, Ill. Figure 58 shows the Gale Chilled plow with iron beam, made by the Gale Manufacturing Co., Albion, Mich., and designed for heavy work. Figure 59 represents the Adamant plows made by the New York Plow Co., of New York city. These plows are extremely hard and consequently very durable. They are also fitted with "slip-points," Figure 60, by means of which the cost of repairs is greatly reduced, while the plow can be constantly kept sharp. Figure 61 represents the Oneonta Clipper, a swivel-plow made by the Belcher & Taylor Agricultural Tool Co., Chicopee Falls, Mass. This plow is specially designed for use on side hills, but works perfectly on level land. By a movement of the foot the plow can be turned without removing the hands. Unlike most reversible plows this is so arranged that the plowman can easily walk in the furrow. Figure 62 shows a large sulky plow. Figure 63 represents a steel gang-plow made by Collins & Co., of New York city.

The ROLLER is another implement which every farmer ought to have, but which many farmers get along without. The best ones for ordinary use are made of cast iron, in several sections. For use on clay land which has become baked and very hard, a heavy iron-roller which has a large number of teeth upon its outer surface may be needed. For lighter work as a clod-crusher, a log may be drawn over the ground without rolling.

Where the lumps of earth are not extremely hard, such an implement will do very fair work. We have used a square stick of timber for this purpose with good results. A round stick is better, as it will not be as likely to clog. Such an implement can be made for either one or two horses. For the former a pair of shafts will be needed, while the latter requires a pole similar to that of a wagon. But the genuine roller is very much better, and is really needed on many kinds of soil. If there are no clods to crush, it is often an object to smooth the land, grass seed can sometimes be best got in with a roller, and in a great many cases it will prove a very useful implement. If the farmer owns but little land, and feels unable to purchase an iron roller, it will certainly pay him to make a good wooden one. Some farmers construct rollers of plank, and make very good ones. These rollers should be made in two sections for convenience in turning

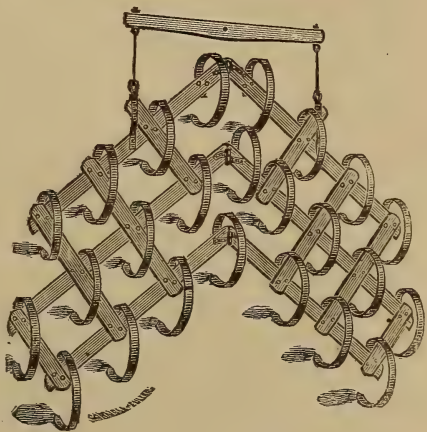


FIG. 67.—SPRING TOOTH HARROW.

around. If this form is considered too expensive, a very decent roller can be made, at small cost, of a straight log. The length and size of the log should be adapted to the strength of the team which is to draw it. Figure 64 represents one of the best iron rollers.

THE HARROW is a very important implement, and one which has no substitute. It should be found on the very smallest farm, and on a large farm several harrows, of different forms and for different purposes, will be required. Many different forms have been devised. The triangular harrow, made in the form of a letter A, and having large, long teeth, has always

been a favorite for use among stumps, stones, or on very rough ground. The square harrow has many more teeth, is lighter, does not draw as hard, is better to handle, and on smooth land will do better work. It should be made in two sections, joined at the sides by hinges which can readily be separated. Both these styles are open to the objection of being very easily clogged. Figure 65 shows the too frequent condition of the teeth. When clogged they accomplish but little, while the labor of the team is greatly increased. By the use of slanting teeth this difficulty is wholly avoided, the efficiency of the implement is very greatly increased, while the draft is considerably reduced. This form of harrow is represented by Figure 66. It was invented by J. J. Thomas, Esq., the well-known author of several valuable agricultural books, and one of the editors of the "Country Gentleman," and is manufactured by the Thomas Smoothing-Harrow Co., Geneva, N. Y.

Figure 67 shows a new style of harrow made by G. B. Olin & Co., Perry, N. Y. This form readily adapts itself to uneven land, can be adjusted to work deep or shallow, draws easily, while the teeth readily pass over obstructions. Figure 68 represents a combined clod-crusher, pulverizer, and leveler, which is manufactured by Nash & Brother, of New York city. The leveling bar breaks down the lumps, and levels the surface, while the curved steel coulters cut the soil, and leave it very loose and fine. This is a valuable implement, especially for use on inverted sod, and on hard and rough fields. Figure 69 shows the Randall Harrow, made by the Warrior Mower Co., Little Falls, N. Y. This convenient and wonderfully efficient implement is too well known to need description. It can be used either as a stiff or a jointed harrow, can be set at different angles, and will pulverize the soil rapidly, and leave it in excellent condition.

Planters, cultivators, and harvesters have already been illustrated. For use on large farms, a Horse-Fork is almost indis-

pensable, and it proves a great convenience on small ones. By means of various attachments this implement can be used for pitching hay into a window, and for distributing it over quite a

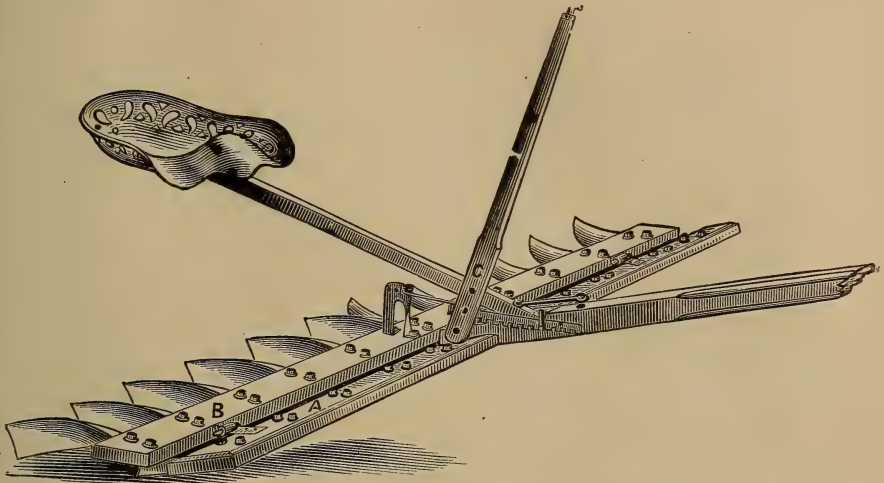


FIG. 68.—ACME CLOD-CRUSHER, LEVELER AND PULVERIZER.

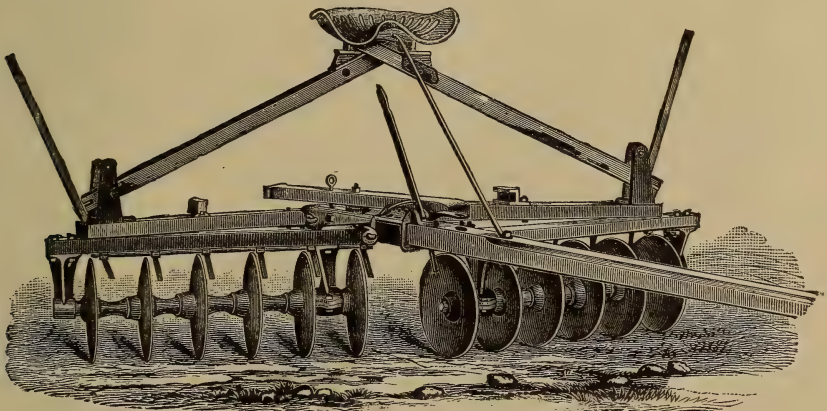
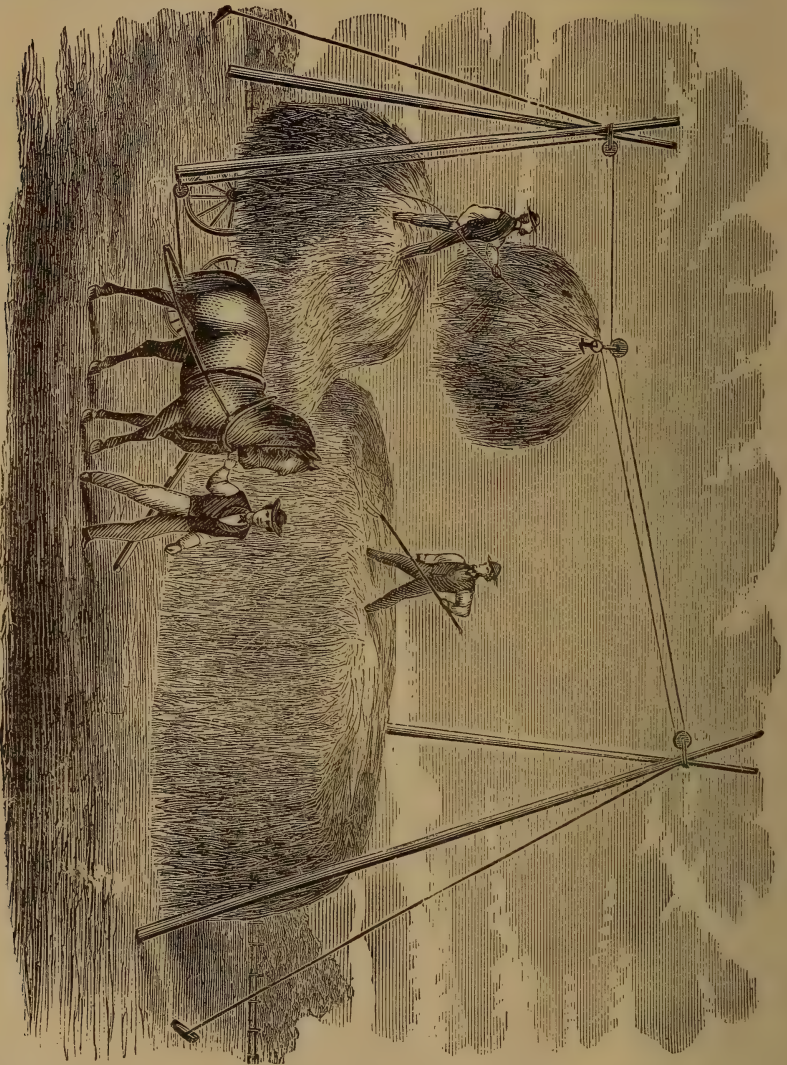


FIG. 69.—RANDALL HARROW.

large surface on the mow if desired. These forks save a great deal of hard labor, and do their work very rapidly. They can be advantageously used in building hay-stacks, as well as for unloading at the barn. Figure 70 represents the method of stacking hay by means of this implement.

In order to shell and clean the vast quantities of grain now produced, machines for the purpose are an absolute necessity. Many different kinds have been invented, and several have come

FIG. 70.—HORSE FORK IN OPERATION.



into extensive use. Many farmers who grow a large quantity of grain prefer to hire their threshing done, rather than buy a machine and run it themselves. Hence there are, in the grain-growing regions, many men who make a business of threshing

for others. In some respects it is better to hire the work done, while in others this course does not seem advisable. On a large farm there should be a power of some kind for other purposes, and the man who has power for doing the work can usually do it cheaper than he can hire it done. In buying a machine care should be taken to obtain one which runs easily, which is durable, and which will do the work well. There are several excellent machines in the market. Figure 71 represents the Farquhar Thresher and Cleaner, made by A. B. Farquhar, York, Pa. This machine received the medal and highest diploma at the Centennial and at the Paris Exposition.

Figure 72 shows a simple but effective machine for gathering the heads of the clover-plant. By its use a man and horse can collect the heads at the rate of an acre per hour.

For cleaning grain, a fanning-mill is needed on every farm. When the business of the farm is so small that it does not seem to justify the expense of securing a machine, several neighbors may unite in the purchase of a good mill, and use it in common. Figure 73 shows Montgomery's Rockaway Fan, made by Dorsey, Moore & Co., Baltimore, Md.

A good Corn-Husker is a great necessity in all the large corn-growing regions, and would be a great help to a multitude of farmers doing only a small business. At the Pennsylvania State Fair, in 1879, a machine of this description was exhibited, and attracted considerable attention. It seems to be perfectly adapted to the work which it is designed to perform. It is a simple machine, and not liable to get out of order. It can be used at the barn or taken into the field. The stalks are thrown into the machine and carried, butts forward, by an endless apron to a pair of corrugated and grooved rollers, which draw the stalks through and push the ears out of the husks. This machine can be run by hand or power. The rapidity of its operation depends upon the size of the machine, and the power applied. The cost of the smaller sizes is fifty dollars. C. D.

Richardson & Co., of Philadelphia, Pa., are the owners of the patent.

The same company also exhibited a Corn-Harvester, which is a valuable implement for use at the WEST and SOUTH. This machine is to be used in the field. When the corn is fully ripe, the machine is drawn through the field—the horses walking between the rows. It cuts the stalks near the ground, throws them into the machine where they are drawn between rollers,

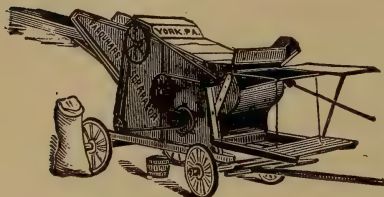


FIG. 71.—THRESHER AND CLEANER.

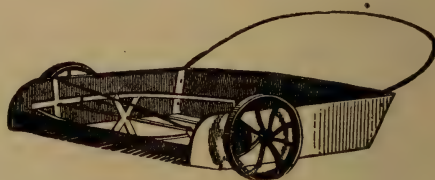


FIG. 72.—CLOVER-SEED GATHERER.

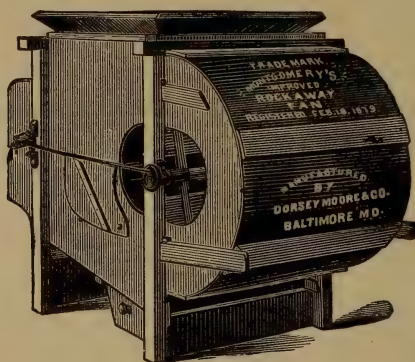


FIG. 73.—ROCKAWAY FAN.

and the ears husked in the same manner as with the Corn-Husker. The ears can be dropped into a hopper, carried by an elevator to chute, and thence to a wagon drawn behind the machine. The stalks are made into bundles, and dropped upon the ground. This machine costs about two hundred dollars. With a good team, eight or ten acres of corn per day can be harvested.

THE CORN-SHELLER is a machine which is needed on nearly all farms where corn is grown. Figure 74 shows an excellent

hand-machine, made by the Sandwich Manufacturing Co., Sandwich, Ill. Figure 75 shows the power Shuck-Sheller, manufactured by Kingsland, Ferguson & Co., St. Louis, Mo. This simple and durable machine proves very valuable in the large corn-growing sections. It shells corn clean with the husks on or after it has been husked, and does the work very rapidly.

FARM-MILLS, for grinding corn and other kinds of grain, have long been considered indispensable by large farmers. That it pays to grind corn before it is fed to stock, seems to have been abundantly proved by careful experiment and by the long experience of a multitude of farmers. And, in most cases, when a farmer has a power by which it can be driven, it will pay to

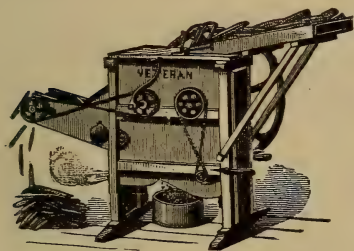


FIG. 74.—VETERAN CORN-SHELLER.

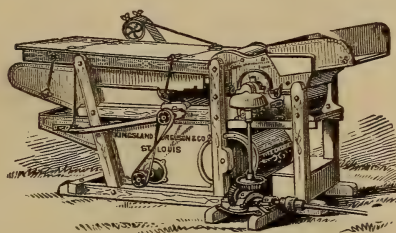


FIG. 75.—SHUCK-SHELLER.

obtain a mill of his own. It is quite an expense of time and money to get the grinding done away from home. On a large farm, which is principally devoted to grain-growing and live-stock, a good mill will pay for itself in a single year. Figure 76 represents a valuable farm-mill, manufactured by Wm. L. Boyer & Bro., Philadelphia, Pa. These mills will grind from four to six bushels of corn per hour when driven by one-horse, and twice as much when a two-horse power is used. Corn can be ground either shelled or in the ear, and other kinds of grain can be ground fine or coarse, as may be desired. As the grinding surfaces are self-sharpening, and the whole mill very durable, there will be but little expense for repairs.

A cider or wine mill, if used only as it should be, would prove a valuable implement to quite a large number of farmers.

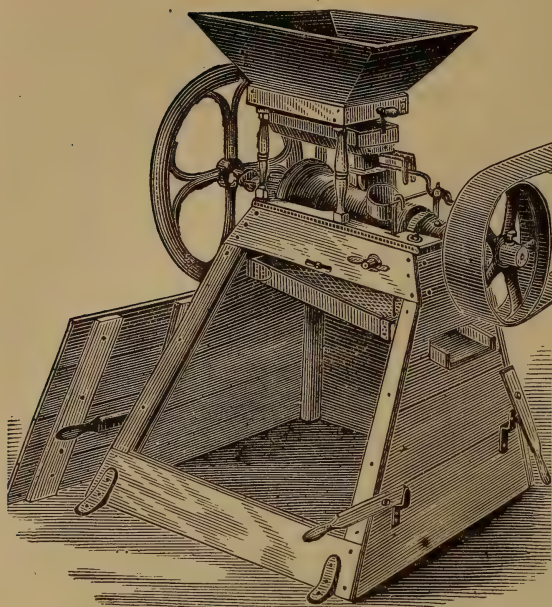


FIG. 76.—BOYER'S PORTABLE FARM GRIST-MILL.

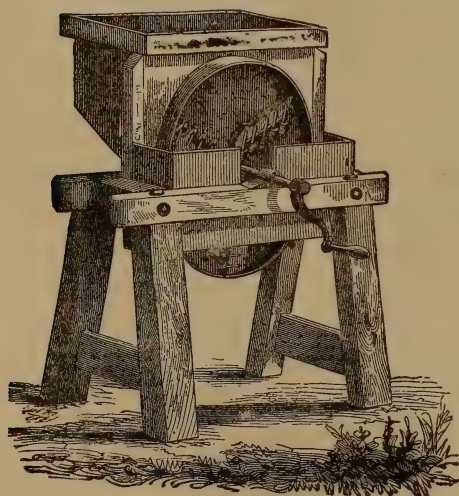


FIG. 77.—ROOT-CUTTER.

We consider pure cider-vinegar a valuable article, and wish the supply could be so largely increased as to drive out the abominable, health-destroying acids which have so largely taken its place in all city markets. For this purpose cider is required, and a better quality can usually be ob-

tained by using a small mill at home than will be secured if the apples are drawn to a large mill, where good and poor ones are mixed and no special care is taken to make a fine grade. But as far as cider and wine for drinking purposes are concerned, we are strongly opposed to their manufacture.

Wherever roots are grown for stock, a machine for cutting them should be provided. A simple, but very good, machine for this purpose is made by William L. Boyer & Bro., Philadelphia, Pa., and represented by Figure 77:

STRAW-CUTTERS are also needed on almost every farm. By cutting, steaming, and applying meal, good straw and the poorer qualities of hay can be made quite palatable to stock, and the animals will thrive when fed upon them. Coarse hay for bedding ought to be cut before it is used in cows' stables. These machines cost but little. Heavier ones, for use with power, adapted to the cutting of straw or corn-fodder, are used on many large farms, and soon pay for themselves. If only a light one is wanted, and the cost is not easily to be met, an ingenious farmer can buy a knife and make a machine which will answer his purpose. The cost will then be very small, and the machine will be likely to answer until the owner becomes better able to buy one.

It is well known that the efficiency of a mower or reaper, as well as the degree of power required to operate it, will largely depend upon the condition of the knives. The best machine with dull knives will draw hard and fail to do first-class work. In order to keep the harvesting machines working nicely, the knives must be frequently ground. Not only this, but they must be ground well. They should be held upon the stone at the right angle, in order that the grinding may be in the right direction, and also to prevent an undue grinding away of the cutters. As an aid to the farmer in grinding the knives perfectly true, the implement represented by Figure 78, and made by Powell, Stevens & Douglas, Waukegan, Ill., is very useful.

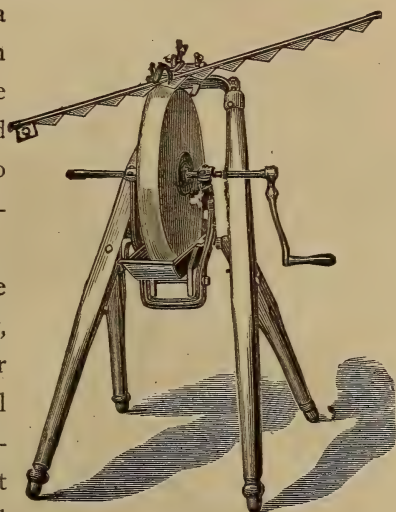


FIG. 78.—SICKLE-GRINDER.

In some sections of the country a STUMP-PULLER is a great

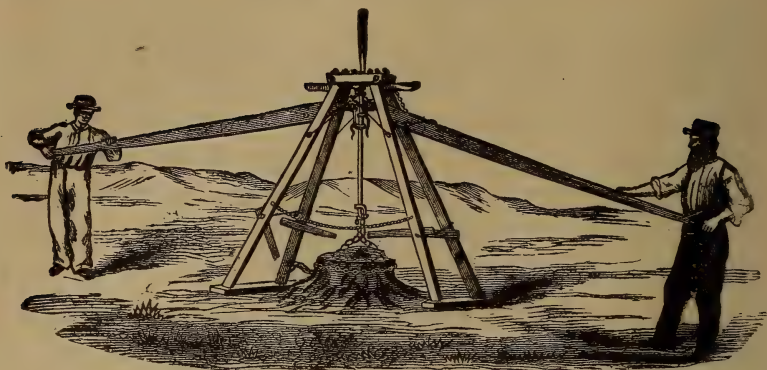


FIG. 79.—ARCHIMEDEAN STUMP-PULLER.

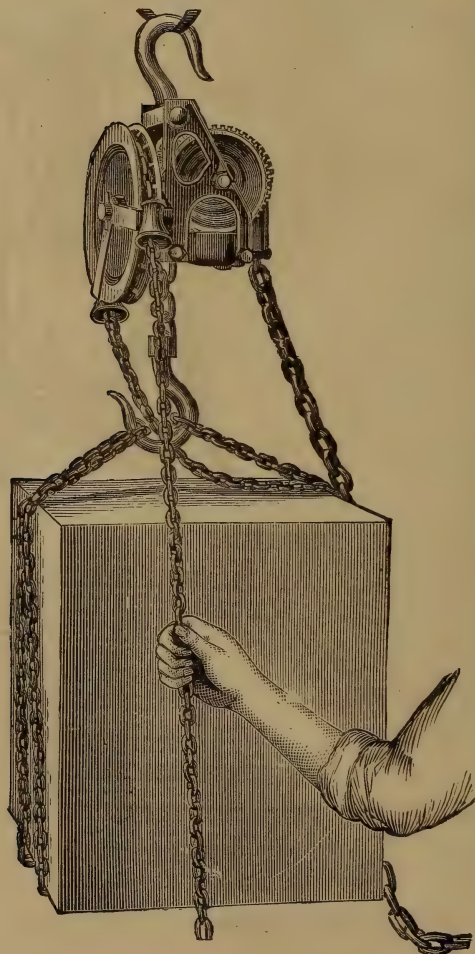


FIG. 80.—BOX'S PORTABLE HOISTING MACHINE.

convenience. Figure 79 represents a portable implement of this description which is made by A. B. Farquhar, York, Pa. It is simple and very strong. By its aid two men can raise twenty-five thousand pounds, while four men with a larger size can raise fifty thousand pounds. For pulling stumps and lifting rocks this is a valuable implement.

A PORTABLE HOISTING MACHINE is often needed upon large farms, and is frequently useful upon small ones. There are many purposes for which such a machine is required, and its use would save many heavy lifts and much hard labor. Figure 80 shows a machine which attracted a great deal of attention at the Pennsylvania State Fair, in 1879, and which received the first premium there, and at the Mis-

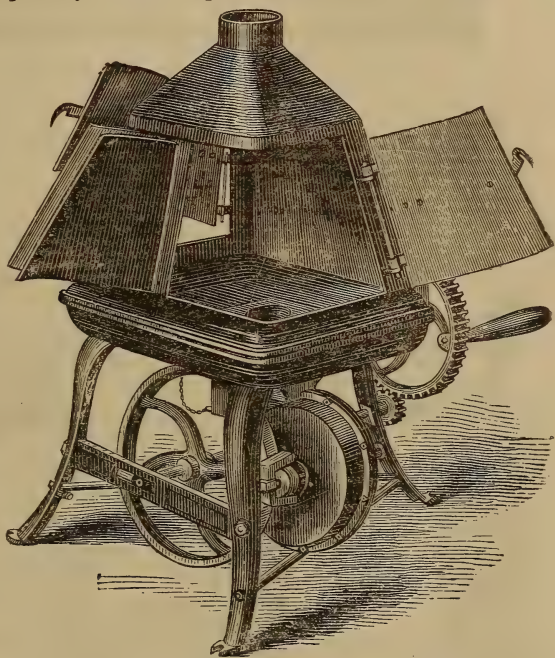


FIG. 81.—EMPIRE PORTABLE FORGE.

souri State Fair. With this machine one man can lift from two to ten tons. The load is held by the machine at any point, but lowers rapidly when started by the operator. This machine is made by Alfred Box & Co., Philadelphia, Pa. It is very strong and durable, and is not likely to get out of order.

A good FORGE is a good thing on any farm, and may be considered almost indispensable to the man who owns much land and uses many tools. He may get along without it, but not without

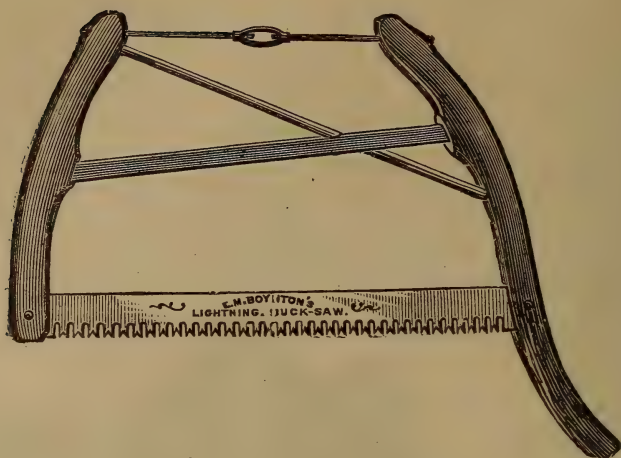


FIG. 82.—LIGHTNING BUCK-SAW.

FIG. 83.

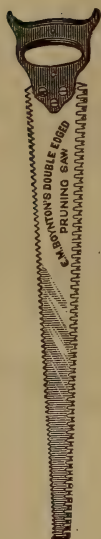
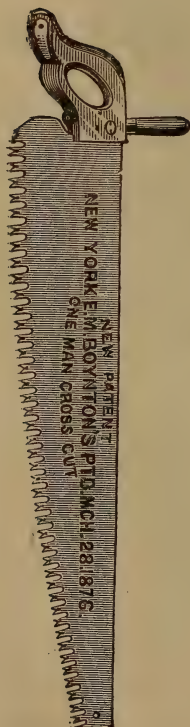


FIG. 84.—LIGHTNING HAND-SAW.

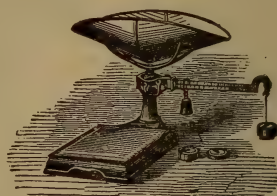


FIG. 85.—FAMILY SCALE.

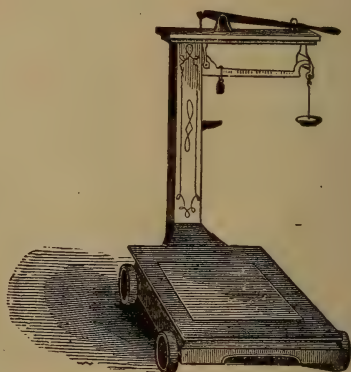


FIG. 86.—PORTABLE PLATFORM-SCALE.

incurring considerable loss thereby. The ingenious farmer who has a good forge can often repair his wagon in half the time which would be required to take it to the blacksmith. He can also put a new bolt in the reaper in place of a broken one, and thus save time when each hour is of great value. Many other repairs can be made which will take but little time, and cost but little for material, which would otherwise have to be sent to town at considerable loss of time and quite a pecuniary expense. With a good forge, and a supply of bolts, screws, nails, and small iron ware, which every farmer would do well to keep on hand, a great many jobs could be done at home. There would not only be the saving of time and expense to which we have alluded, but the repairs would be more likely to receive prompt attention than they would if the wagons or machines were to be sent to a blacksmith. In this way a great deal of useless wear would be saved. One bolt put in at the very beginning of an indication that it is needed is worth more than half a dozen bolts put in after the parts have worn loose and got entirely out of order. Figure 81 represents a first-class forge for use on the farm. This, with many other styles, is made by the EMPIRE PORTABLE FORGE CO., Cohoes, N. Y.

In those sections in which wood is used for fuel, saws will be needed for fitting it for the stove. Figure 82 represents a wood-saw which is a very great improvement over the old-fashioned style. We have used one of these saws several years, and found it a valuable implement. Figure 83 shows a saw for cutting off logs. Figure 84 shows a hand-saw for use in pruning trees and cutting boards. All these saws are made by E. M. Boynton, New York city.

SCALES for weighing the products of the farm are very important implements, and no farmer should try to get along without them. Without scales the farmer is liable to sustain many losses in different ways, and in the course of a year he will be fortunate if he does not lose for want of them more than the

scales would cost. On a large farm scales weighing at least two tons should be placed in the barn-floor, and there should be small ones at the house for weighing milk, butter, poultry, and

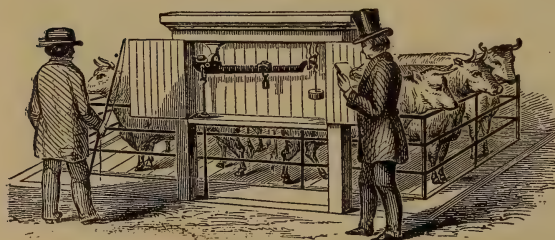
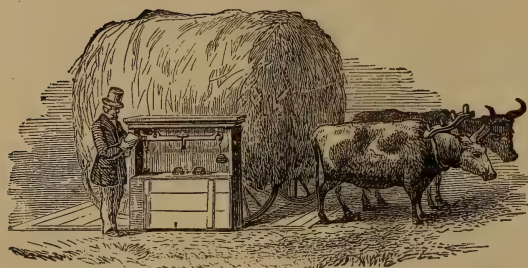


FIG. 87.

similar articles.

On a small farm there should be scales which will be convenient for weighing lambs, calves, and grain, while some light ones in the house should be kept for weighing the articles which are sold from the dairy, and the lighter class of goods from the farm. Without a good scale it is impossible for a man to thoroughly test the yield of his cows, to carry on careful experiments, and to do many other things which the careful

farmer will desire to perform. He cannot tell whether his grocer deals fairly with him or not, will be obliged to "guess" the weight of his own products, and he will often be put to much inconvenience when no great pecuniary loss is

involved. Figure 85 represents a good Family Scale, and Figure 86 shows a Portable Platform-Scale made by Riehle Brothers, of Philadelphia, Pa. Figure 87 shows the celebrated Fairbanks' scales in operation on the farm.

Something in the line of a PUMP should be found on every farm, and it is desirable that it should be a really good one. Many farmers still use the "old oaken bucket," but under the most favorable circumstances the operation of drawing water with it will be slow and laborious, while in cold weather the poetry connected with the bucket will utterly fail to compensate for its manifest disadvantages. As the wife and children are often obliged to draw water for use in the house, the farmer should provide a pump which will work easily, and also raise water with a reasonable degree of speed. It is quite desirable that the pump should be suitable for throwing water upon the buildings in case of fire.

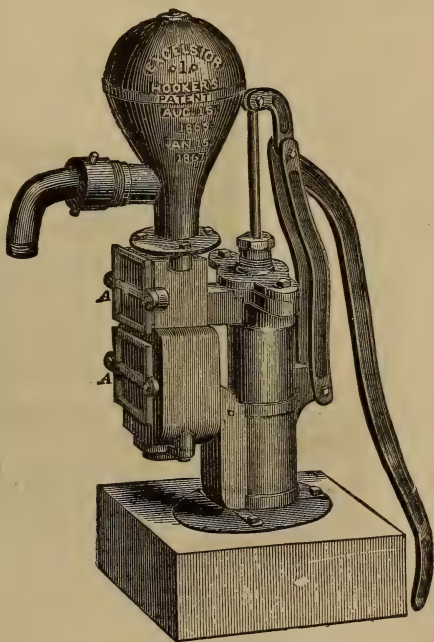


FIG. 88.—EXCELSIOR SUCTION AND FORCE-PUMP.

Figure 88 represents a double-acting pump which is adapted for both surface and deep wells, which works easily, throws water rapidly, and has a strong forcing capacity. This pump is very useful on a farm. As it is put together with bolts it is easy to get at the valves in case it should be desirable to change them. This pump is manufactured by Cooper, Jones & Cadbury, Philadelphia, Pa.

The class of HOUSEHOLD MACHINES is not very large. Among the best implements of the kind are machines for washing, wringing, and ironing clothes. Of WASHING MACHINES there is an almost unlimited number, and, if we except the single implement of the churn, there are more worthless machines of this description than of all other kinds put together. There are a very few good patterns. But most of the washers give satisfaction for only a short time, and are soon laid aside. Either in the cellar or garret of a large number of farm-houses can be found

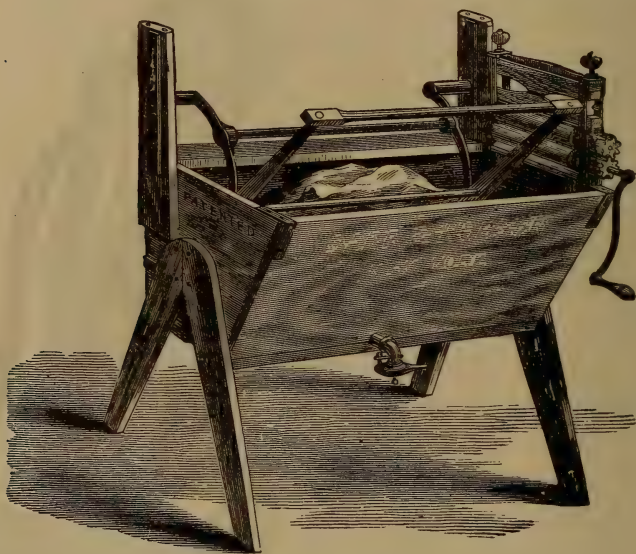


FIG. 89.—BEEBE WASHING MACHINE.

one or more discarded washing machines which have been tried and proved defective. Farmers have bought so many poor ones that they have come to look with a great deal of distrust upon every new washer which is brought to their attention. But, while the market is flooded with poor ones, there are machines which are a real help, and every farmer's wife ought to have one. Washing is hard work, and, in connection with the other duties of the house, is too heavy for one woman to do by main strength. With a good machine the work can be done

in less time, and with but little very hard work. Figure 89 represents a good machine which is made by A. B. Farquhar, York, Pa.

A CLOTHES-WRINGER is considered by many housekeepers as far superior to a washing machine. There may be some excuse for the farmer who does not keep a good washing machine, but the man who neglects to provide a good clothes-wringer does a great wrong. Good wringers can be secured for low prices. They save a great deal of time, and of exceedingly hard work. They are not merely convenient machines for the use of the well-to-do classes, but they are necessities to all women who are obliged to wash, and who can possibly afford the expense. One of the best, as well as best known, styles is made by the Metropolitan Washing Machine Co., of New York city, and is represented by Figure 90.

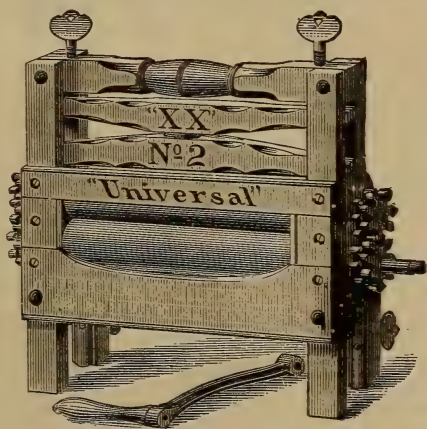


FIG. 90.—CLOTHES-WRINGER.

To those who can afford to buy one, and a great many farmers can, a MANGLE, or ironing machine, will prove very useful. A good machine for family use is represented by Figure 91. It is made by the Standard Laundry Machinery Co., of Boston, Mass. The use of this machine saves fuel, as it irons the clothes without heat, saves a great deal of time and labor, and does not injure the fabrics as hot irons always do.

THE SEWING MACHINE is now so common that we hardly need to say much in its favor. Yet there are many farmers in all who have not bought, but who certainly ought to furnish these machines. The prices have now been reduced to a reasonable figure, and it would seem as if the last excuse for not

buying a sewing machine had been taken away. With a good machine the farmer's wife can do her sewing easily and rapidly, and will be able to occasionally find a few minutes at a time in

which she can sit down to rest without feeling that she is neglecting some pressing duty.

Such a list as we have attempted must, in the limits assigned for this purpose, necessarily be incomplete, but we have named some of the lead-

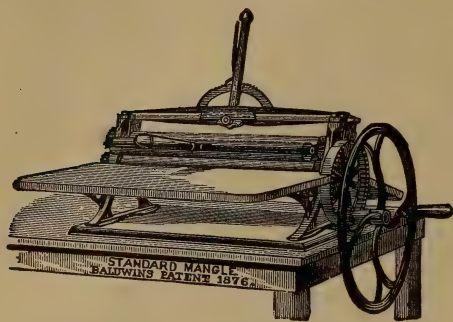


FIG. 91.

ing implements which are either needed universally, or else in large sections of the country.

Many of the farm machines have been incorrectly termed "labor-saving" implements. They do not *save* labor. All the work must be performed with them that would be needed if they were not used. But the labor is *transferred* from man to be performed by animals, wind, and steam. But these machines *do* save time, and crops, and health. By their aid the farmer can do a great deal more than would be possible without them, and can secure crops which under the old system would inevitably suffer a great waste. Then, too, the saving of health is one of the greatest of the various economies secured by the use of machines. The labor can be performed with less physical exhaustion, and more time for rest can be secured. This is a matter of great importance both to the farmer and his family. It is not only infinitely pleasanter, but it is a great deal cheaper to buy machines for doing the work than it is to employ doctors and purchase medicines in order to regain health which has been lost by excessive labor.



LIVE-STOCK.

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LIVE-STOCK ON THE FARM.

THAT the live-stock interest is one of immense importance to the people of this country is evident from the fact that they have more than one and a half billions of dollars invested in domestic animals. This estimate is based upon the actual selling value, and shows the importance of the live-stock business from a financial point of view. If the vast sum of money which is represented by these animals returns a fair rate of interest, they will give a large income to their owners. If they do not make such a return, the money is unwisely invested.

The facts that so large a sum is represented by domestic animals, and that from them the interest, if any is secured, upon this great amount of capital must come, should prove a strong inducement for the owners to give their live-stock the best of care and the closest attention. It is in this way only that the largest possible profit is to be secured. For want of this care and oversight many of the animals kept on our farms prove of no benefit to their owners. Instead of paying six per cent. interest upon the capital which they represent, they hardly pay the expenses of their keeping. Certainly this rate of interest ought to be secured, and the man who fails to receive it should carefully examine his methods of keeping and treatment and find wherein they can be improved. In succeeding chapters we shall endeavor to point out the best and most profitable systems of management.

There are two special and several incidental purposes for which animals are useful to the farmer. They are valuable for the labor which they perform, and for the food which they supply. Some, like the horse, are principally useful as laborers. Some, like the pig, are only good for food; while others, like the ox, are valuable for both labor and food. It is also true that animals are beneficial to the farmer in that they convert the bulky

products of his land, such as hay and grain, into valuable material which occupies a much smaller space, and thereby saves a great expense for transportation. The WESTERN farmer can send his beef to the EASTERN market and get well paid, but he could not profitably send all of his hay so far from home. The freight on a hundred pounds of hay would be as high as it would on a hundred pounds of beef, but the amount of money received for the latter would be five or six times as great as it would for the former. Animals also convert various products of the soil which man cannot eat into some of the finest qualities of food for his support. Man cannot eat the hay with which he fills his barns, or the grass which clothes his pastures, but he can use the beef and mutton which are produced from them. A large part of the fertilizers upon which the farmer's crops are fed are produced by animals. "No cattle, no dung: no dung, no corn," long ago became a proverb among the best farmers in the world. And though chemical fertilizers have been discovered which promise, and which are also able to perform, great things in the line of agricultural advancement, it is still true that merely for the production of manure domestic animals are of great value to the farmer.

It may be accepted as a settled principle that upon every farm one or more animals should be kept, for at least part of the time, for the labor which they are able to perform. In thickly settled countries like China, where each man owns but a very small area of land, it is possible to do by hand the work which the farmers of this country need animals to perform. It is all very true that a thoroughly spaded garden is, by means of the spading, got into a fine condition to receive the seed. If corn fields and wheat fields could be treated in like manner, very large crops might be secured. But our farmers cannot afford to use the spade for loosening and fining the soil. To attempt to prepare a good-sized field in this manner would expose a farmer to the ridicule and contempt of his neighbors,

and involve him in a heavy financial loss. The work might be done very nicely, but its cost would be altogether above the highest price which the owner of the land could afford to pay. In this country operations of this kind must be performed a great deal cheaper than they can possibly be done by hand. It is very necessary that they should be done, and also be done in a thorough manner. Before a crop can be obtained, the land must be fitted for the reception of the seed. But as a means for accomplishing this purpose, hand-power is altogether out of the question. To the ordinary farmer steam-power also is wholly unavailable. It is to the animals which GOD, in infinite wisdom and goodness, has given to man for his aid and service that we must look for the means of fitting our land for the seed, and for gathering the harvest when it is ripe. Laying aside all thought of their other uses, and of the convenience of having such strong and willing servants, we can, in this one item of labor, see that without these animals the farmer would be utterly helpless. With the spade he could prepare but little land, and with the sickle, or the cradle, he could gather but little grain. Without the aid of the animals our fields would be untilled, the great prairies of the WEST unbroken, and business of every kind would come to a speedy end. In calling attention to the great necessity of help from the animal creation, and to the weakness of man without this aid, we hope to impress upon the minds of our readers not only the fact of indebtedness to the creatures which patiently labor for the advancement of the material interests of their owners, but also to awaken a sense of duty to treat these animals with the kindness and consideration which they deserve.

Of the animals which are kept on the farm for the main purpose of being fitted for food, the cattle, sheep, and pig are of the greatest value. In certain sections of the country it pays well to grow and fatten these animals for the market. In other places the winters are so long and severe, and the soil so poorly

adapted for pasturage in the summer that the expense of keeping animals is very great, and it does not pay to attempt to conduct the live-stock business with special reference to supplying the market with animal food. At the WEST, where the land is cheap, corn sells for an extremely low price, and grass and hay can be had in abundance, meat can be furnished very much cheaper than it can in NEW ENGLAND. In TEXAS, with its vast territory, its luxuriant pastures, and its mild climate, beef can be produced for a much lower price than it can even in the most favored parts of the WEST.

It is not wise for the NEW ENGLAND farmer to attempt, on a large scale, to compete, in this line of business, with the cattle owners of TEXAS and the WEST. Twenty years ago it paid EASTERN farmers well to fatten oxen for the NEW ENGLAND market. But since the WEST and SOUTH have gone extensively into the work of growing live-stock and sending it all over the country, the prices of various kinds of meat have declined and the demand has been more than supplied. The EASTERN farmer can still furnish the meat needed in his own family and sell to some extent in the home market, but he will hardly be able to compete in the large city markets with stock-owners who are much better situated for its production. It is possible, however, that the trade in meat with GREAT BRITAIN, which is assuming large proportions and now seems to be firmly established, will divert the surplus products of the WEST and SOUTH to such an extent as to open the EASTERN city markets again for supplies from their own section. If this proves to be the case, EASTERN stock-owners should accept the opportunity and strive to build up a profitable business. The same principle which governs in the production of beef, which as a matter of convenience has been specially considered, also applies to the other kinds of animal food.

The live-stock business offers to almost every farmer an opportunity for financial gains. But these gains are to be

secured by keeping the best animals and giving them the best of care. A poor class of stock may nearly, or if not *too* poor may quite, pay its way. A great deal of the stock kept on the farm is of this description. But it should not be considered sufficient that the keeping of the animals involves no direct loss. By careful attention to the principles of breeding the average farmer can obtain a better grade of stock. If he will sell his inferior animals and fill their places with better ones, he can effect a gradual improvement without incurring a very heavy expense. By keeping the best of his animals for breeding purposes instead of selling them to the butcher, and taking good care of them, the farmer can soon obtain a class of stock which will be sure to yield him a fair percentage of profit.



THE HORSE.

AN able writer has said, and there are few if any who question the truth of his assertion, that "There is no better beast in the world than a horse, nor any one which, though often most cruelly misused by man, so well deserves, and so amply, by his services, repays the best usage." Unlike most of the animals which promote the comfort and increase the happiness of mankind, the horse is found in all the habitable parts of the globe. In all climates and temperatures where grass can grow or man abide, the horse may be found his willing and efficient servant. A necessity to the savage and the half-civilized races, he is also indispensable to the people who have obtained the highest culture and the greatest degree of control over the forces of nature. The barbarous nations which know nothing of steam or electricity and who have no means of utilizing the power so freely furnished by wind and water, are dependent upon the horse for the aid which they need in the work which they attempt to perform. But the civilized races,

although they can control these great powers of which the barbarian knows nothing, are also dependent, in a very great degree, upon the horse for their comfort and prosperity. All classes and conditions of men need the help of this useful animal. The work of the world could not go on without his aid. This fact should cause the people to whom he is so invaluable to treat him kindly, and supply, with a liberal hand, the food and protection which he requires.

In this country we have horses of nearly all descriptions and adapted to almost every conceivable purpose. But as this work is designed especially for farmers, we shall confine our remarks to the growing and management of horses which are serviceable on the farm. By this we do not design to intimate that we shall treat only of a low grade of horses. Though there are many very poor horses kept on our farms they ought not to hold the positions which they now occupy. A poor horse is not suitable for the farm. While great speed is not required, it is still true that the finest horses are none too good for the farmer's use. On a farm, as truly as on the road, the best horses give the best satisfaction and are the most profitable to their owners. Our farmers have been too long contented with a low class of horses, and have suffered great and constant losses by their quiet acceptance of an inferior grade of these most useful and valuable animals. While the poor horses which so many farmers have kept, and with which they have been so well satisfied, have been of incalculable value and have made possible the accomplishment of an immense amount of work for the performance of which no other class of animals could have been secured, it is still true that if a better grade of horses had been owned, a still greater degree of success would have been obtained. It is not wise for the farmer to buy very expensive horses, but he ought to have those which are really good and useful. If he can afford to keep a horse of any kind, he can afford to keep a good one. If a good one cannot be made to pay the expenses of his keep-

ing, a poor one will be almost sure to involve his owner in an actual loss.

The qualities which are required in a good horse for the farm are a *good disposition, strength, endurance, and activity*. It is also quite desirable that the farm horse should be nicely formed, beautifully colored, be a good traveller, and carry himself elegantly when in motion. These qualities are desirable, but they are not essential. Some of the best of farm horses are deficient in one or all of them. But in order to perform the best service for his master the farm horse must possess each and all of the qualities which are named in the list of requisites which has been given.

A GOOD DISPOSITION is of the greatest importance. Without the other qualities which we have marked as essentials, the horse becomes worthless to the farmer, but without a good disposition he becomes not merely unserviceable but positively dangerous. Although a good horse is one of the best patterns of kindness and fidelity in the whole animal world, a vicious horse is one of the most violent, revengeful, and unrelenting creatures with which man attempts to cope. Until subdued by the wonderful skill of RAREY, the celebrated ENGLISH stallion CRUSIER was a far more dangerous animal than a lion. And instances in this country in which vicious stallions kill their grooms and ugly horses disable or destroy their owners are not very infrequently reported in our newspapers. Such occurrences are altogether too common. They can be avoided by following one simple rule—that of never using or keeping a vicious horse. There is no other safe way. The man who handles a vicious horse is in constant danger. All may go well for years and yet in some unexpected moment the animal may exercise all his destructive power. If the owner is extremely careful he may not be injured, but the risk is very great and ought never to be taken. Less difficult to get along with than these violent creatures, but still unsafe to handle in the manner in which farm

horses are usually managed, are the sullen and sour-tempered horses which are so often seen and which frequently cause no small amount of mischief. These horses are not often very violent, but are liable to bite or kick when displeased with their treatment or surroundings. In many cases they will not attack the master, but will wreak their vengeance upon children or strangers who happen to be near when things do not suit them. Such horses should never be kept on the farm. They are decidedly unsafe to have around under the treatment which farm horses receive. If used anywhere they should be put upon stage lines, or horse-car routes, where they can have steady and tolerably severe work, and where their evil propensities can be more easily restrained than they can be on a farm. When the danger to all who use them, and especially to the aged, women, and children, is considered, it seems strange that any one will keep a horse which has any trace of viciousness in its disposition.

That the farm horse will require a great deal of STRENGTH is clearly evident when the nature of the work for the performance of which he is required is considered. The fleet carriage horse which moves so gracefully along the road would prove of but little value when hitched to a plow which is to be drawn through a heavy sod. Not only for plowing but also for a large part of the other work required on the farm a high degree of strength is absolutely necessary. Even the harrowing of the land after it has been plowed involves a heavy draft. The cultivation of the crops, cutting, and drawing them to the stack or the barn are operations which require a strong team for their rapid and profitable performance. While it is possible to accomplish something with a weak team, no one who has had the slightest experience in the premises will doubt that all the work which is thus carried on will be done at a great disadvantage. We have known farmers to plow their land shallow because they did not have a team with strength enough to plow it to a suitable

depth. The team was also too weak to do all the harrowing which ought to have been given. In all the preparatory operations the team was inefficient, but when harvest came it was found abundantly able to draw all the crops which with this defective system of culture had been obtained. The work which can be profitably done on a farm cannot be performed without the exercise of a great deal of strength. A weak team will, from the very nature of the case, prepare the land for the production of small and unprofitable crops.

It is not only important that a sufficient degree of strength should be provided but also that it should be furnished by a small number of animals. A great and constant waste is involved in keeping three horses to do the work which two ought to be fully able to perform. Every one can see that such a course involves the waste of considerable hay and grain, quite an expense for shoeing and harnesses, the loss of interest on quite a little sum of money, and the withdrawal of an amount of capital equal to the selling value of the animal from employment in profitable departments of the business of the farm. Keeping more horses than are needed inevitably involves the owner in loss. We do not here refer to horses which are kept for pleasure-driving, or to the extra horses which some farmers think that they can profitably keep for use during the busiest part of the season. But, while the same principle applies pretty generally to them all, we now have in mind the horses which are kept as extras in order to atone for the deficiencies of those which should form the farm team. Instead of keeping these animals it is much better for the farmer who has a small and weak team to sell it and then buy a stronger one. It will be a great deal cheaper to keep two strong horses than it will to support three weak ones, and the greater convenience of using the pair will be another, and should be a sufficient reason for making the exchange.

In selecting horses for farm work the buyer must be careful

to distinguish between size and strength. It is a common opinion that large horses are very strong and small horses comparatively weak. While it is true that when other things are equal a large horse is stronger than a small one, it is not always safe to assume that because a horse is large he must be very strong, or that because another is much smaller he is a great deal weaker. The greater weight of the large horse is much in his favor when drawing heavy loads, especially over rising ground, but strength does not wholly depend either upon weight or size, and a small horse *may* be stronger than a large one. Farmers who judge of horses merely by their size are often very badly deceived and frequently overload their teams. The strength of a horse depends far more upon his form and the perfection of his muscular development than it does upon his actual size. We do not wish to be understood as saying that small horses *are* usually stronger than large ones. They are sometimes stronger, but not always. In proportion to their weight when in the same general condition we believe the medium-sized horses will prove stronger than those which are excessively large, and in some cases a small horse will prove much stronger than one which is of considerably larger size. In selecting a horse, size must be considered, but it is not the only standard by which to test either his strength or his value.

ENDURANCE is one of the leading qualities of a first-rate farm horse. Many horses are kind and strong which cannot endure, without discomfort and injury, the hard labor which at some seasons of the year the farmer requires his team to perform. We think that the work of a farm is much more trying to the endurance of a horse than that of many kinds of business which are usually considered much more severe. The horse-car companies require severe and protracted labor of the animals which they keep in use, but they feed in the best possible manner, while the hours of labor are regular and the work nearly uniform in its demands upon the strength. But on the farm there are

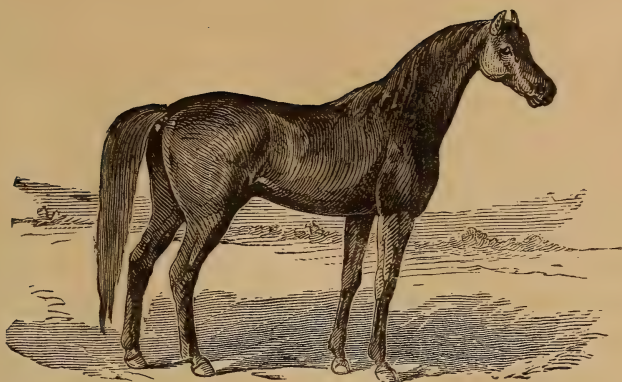
many days in which no work at all is required, and periods of considerable length in which but comparatively little labor is performed by the horses in the team. But in the busy seasons of seeding and harvest there is a very severe and long-continued strain upon their powers of endurance. During these seasons many horses are injured which would have performed a great deal of hard labor if it had been more evenly distributed throughout the year. To work extremely hard for two weeks after a period of idleness and then be kept in the barn for a few weeks until another busy time comes is a severer strain upon a horse than regular labor six days in the week. The aggregate amount of work performed in the latter case may greatly exceed that under the former method, and yet the horse keep in better condition and be less likely to be sick or injured than he will under the former system of less, but irregular, labor. This is readily accounted for by the fact that one system is in accordance with, while the other is in violation of physiological laws.

Then, too, the feeding of the horse on the farm is not always managed to the best advantage, and the powers of endurance of the horses employed are severely taxed by its irregularity or its inappropriateness. While the car horse has regular hours of feeding, and a certain quantity and quality of food, the farm horse is often fed at irregular intervals, and is given the kind of food which it is the most convenient for his owner to supply. The horses on the farm are sometimes started out very early in the morning, while on other days they have but little to do until after noon. Sometimes they are put in the stables in good season, while at others they are kept at work until late in the evening. This irregularity of labor necessarily involves an equal irregularity of feeding, and the two combined bring a hard strain upon the powers of endurance of the team.

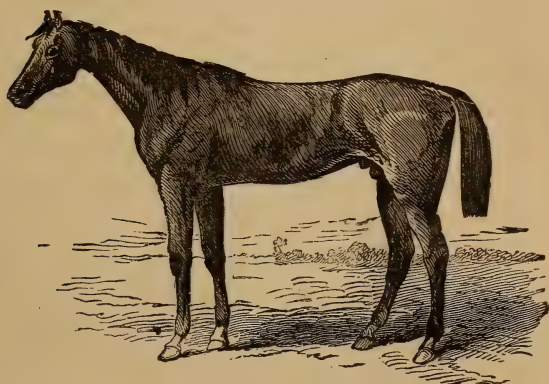
ACTIVITY is one of the qualities which the farm horse should possess. It is not necessary, perhaps it is not desirable, that he should be fleet on the road. A good traveller may be one of

the poorest of all horses for farm work. This is not necessarily the case, but it often happens. The first-class travellers are often too restive and nervous to cheerfully submit to the slow and toilsome processes by which much of the work of the farm must be performed. But there are a great many horses which are quiet and tractable and still very active. When required for drawing loads they do not go by fits and starts, like too many fast horses, but take a quiet yet rapid gait and hold it until the work is done. Some horses, which work steadily, go too fast. It is hard for a man to follow them with a plow, and they are almost sure to work beyond their strength.

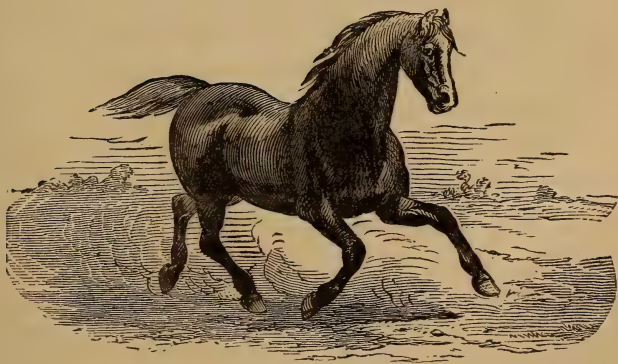
We know of a pair of horses, which, with an ordinary plow, can plow two and a half acres of land in a day. These horses walk steadily but very fast. They do too much. They are neither very large nor very strong, and ought never to plow more than two acres in a day. But this is a very unusual failing among horses which are kept for work. But very few farm horses which work steadily work too fast. The great majority are altogether too slow. Too many of the farm teams not only "draw like oxen" in point of steadiness, but also resemble them in respect to the time required for the performance of a given piece of work. While a slow and quiet team is much better than one which is nervous and unsteady, there is a mean between these two extremes which is greatly to be preferred to either of them. There are many kinds of work on the farm which require activity rather than great strength for their profitable performance. In harrowing stubble land, bushing in grass seed, and many of the lighter kinds of the work of the farm, a team which will work rapidly, yet quietly, will accomplish a great deal more than one of equal strength which is slow. In the course of a year it makes a great deal of difference with the progress of the work and the amount performed, whether the horses are slow or active. In buying a horse for farm use this point should be duly considered.



1



2



3

FIG. 92.

1. Carriage Horse. 2. English Racehorse. 3. American Trotter.

In the training of colts care should be taken to teach them to step quickly. Many horses are naturally slow, and cannot, except by abuse, be made very active. It is of no use to attempt to teach such horses to be spry. They may be somewhat improved, but natural tendencies will show themselves, and prove difficult to control. Instead of whipping such horses to make them go faster, some different kind of work which they can perform at their own gait should be selected for them, and animals which are naturally more active chosen for the farm. But many slow horses were made so by defective training when they were young. If they had been carefully trained they would have been far more active. It is too late to attempt to improve them now, but care should be taken in training the colts which are to supply the farm teams in the future. If they exhibit unmistakable signs of dulness they should be trained for slow work. Otherwise they may be educated for the farm or the road.

In order to work at any advantage in the improvement of farm horses, and secure a supply of these which will possess the desirable qualities which they ought to have without the defects which characterize so many of the animals now in use, it will be necessary to commence at the very beginning. As long as the spring remains unclean it is wholly useless to attempt to purify the water at the fountain. And as long as the system of breeding which in many sections has been adopted, and is now prevalent, is pursued, there will be neither the hope nor the possibility of any marked improvement in the character of our farm horses. If we are to have good horses we must take pains in breeding them. There must be more care and a greater degree of skill. More capital must be invested in the business. When we consider the quality of the animals which have been used as breeding stock, we lose every particle of surprise at the poor grade of horses which are found on our farms. The great wonder, to one who has studied the subject, is that there are so

many horses which are good, and so few which are wholly useless. A great many farmers have used for breeding purposes the very poorest stock they had on hand. Cases are numerous in which a farmer has kept a mare until she was old and partially disabled, and then, when she had the heaves, and stumbled, when the sense of sight was failing, and all the powers of life were rapidly on the decline, used her for breeding. It is a common remark among farmers when speaking of an old, unsound, and worthless mare, that she "will do to raise colts." Such mares often are used for this purpose, and here we find an ample reason for the low grade of the ordinary farm horse. And what increases the difficulty, and makes a matter already bad many times worse, is the fact that these mares are taken to stallions which are very much like themselves. If the colt could have strong constitution and vigorous blood on one side of its parentage, there would be some hope that he might be worth something. But the farmer thinks that to take such an old mare to a really excellent stallion will be too expensive. So he casts away all the best chances of success, and obtains a colt from a well-mated, but miserably poor, pair of animals. There are cases in which all this is done ignorantly. MR. MURRAY has said that there is more than one man who hopes to obtain "a Dexter or a Goldsmith Maid" who breeds a mare worth less than fifty dollars to "a horse that is not worth fifty cents." It is not surprising that there are poor colts in the world, but it is astonishing that men will go on breeding horses in such direct violation of all physiological laws, and all the teachings of common sense and experience.

We have alluded to the fact that a great many farmers do not use mares for breeding purposes until they are old and, at least partially, disabled. Now old age alone ought to be a disqualification for breeding purposes. We have shown that the farm horse needs strength, endurance, and activity. Is the colt likely to inherit these vigorous qualities from a dam which is in

the declining years of life? Common sense answers with an emphatic *no*. It is useless to say that the mare has been smart, and fleet, and strong. It is not what the mare has been, but *what she is* while carrying her colt which is to determine his constitutional powers. In the human line we find that the children of aged parents are deficient in vital power. It often happens that in the period of youth the children of such parents begin to show the marks of old age. Their teeth decay, their hair falls out, their eyes grow dim, and all the sensibilities are dulled. The same principles which govern in human life also apply to the brute creation. The ordinary life of the horse cannot be said to exceed twenty-five years, while man lives to be seventy. The children of parents fifty or sixty years of age will inevitably bear the marks of weakness and premature decline. These often appear in infancy. Sometimes they are delayed but they are not prevented. The offspring of aged parents bear the stamp of old age when they should be in the vigor of active life, and their vital powers show signs of failure when they ought to be in their fullest strength.

Now at the age of fifteen the ordinary horse is, comparatively, as old, and the vital powers are as greatly diminished, as a man at fifty. In a multitude of cases the horse is older at fifteen than man at sixty. Yet there are many farmers who do not begin to use their horses for breeding until they are fifteen years of age. This we hold is a great mistake. It is an error which entails a loss of hundreds of thousands of dollars upon our farmers. If the serviceable life of the average horse could be prolonged five years, it would be an immense benefit to all owners of this animal. Such an increase, we firmly believe, might be secured by the use of young instead of old mares for breeding.

Unsoundness is a very great obstacle to the breeding of really good horses. There are many sound mares which are used for breeders, but the great majority of them are altogether too val-

uable to be owned upon the farm. But few of the mares which bring the colts into the world which are to furnish farm horses are young and sound. Old age is joined with other disqualifications very often. And when a farmer is found using a young mare for breeding purposes, there is considerable reason to suspect that there is something wrong about the beast and that on account of this difficulty she has been withdrawn from active farm labor. There are exceptions to this rule, but they are very few. Farmers have not yet been brought to realize the immense importance of a sound parentage. All around them are the evidences of the transmission of disease. The consumptive mother brings forth consumptive children, and the scrofulous father taints the blood of those whom he begets. Many forms of disease have been handed down from father to son for generations. And this tendency to transmit disease is not only as strong in animals as in man, but, owing to the alleviating and counteracting circumstances which the intelligence of men can bring to bear upon their own condition, is still more likely to be permanent. If a mare has the heaves, her colts, if she has any, will almost surely be weak in their organs of respiration. If she is lame, even though the lameness may have had a purely accidental origin, it is quite probable that the colts will in early life also become lame. If the lameness is caused by disease or weakness, it will almost surely be passed down to the colts. Blindness is very sure to be handed down to succeeding generations. And any infirmity, disease or defect is quite likely to place its mark upon the colts produced by the unsound parent.

An animal having a bad temper and a vicious disposition should never be used for breeding. These defects are not only perpetuated, but are very likely to be aggravated in the offspring. It has been well said by MR. MURRAY that "It is a crime to breed an ugly dam either to an ugly horse or a good-natured horse." If either parent is cross or ugly the colt will be almost

certain to inherit this evil quality, while if both parents are bad-tempered an ugly colt may be looked for with a great deal of certainty. As a good disposition is one of the essential requisites of a good farm horse, it is not too much to assert that it is one of the important qualities to be required in those animals which are to determine the character of the horses which are to be produced in the future.

The particular breed of horses which the farmer should keep will depend upon various circumstances. Figure 93 represents a White Percheron-Norman stallion which was imported from France in 1868, and belongs to M. W. Dunham, Wayne, Du

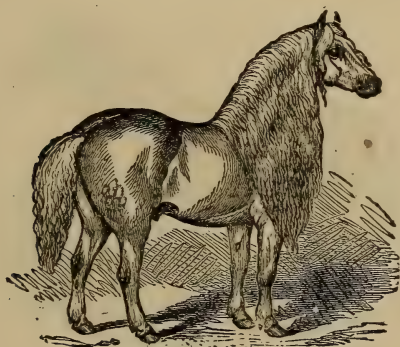


FIG. 93.—“SUCCESS.” 452.

Page Co., Ill. The Percheron horses have long been noted for their power and endurance, and their ability to move rapidly with heavy loads. This breed is very desirable for farm and driving purposes.

The Cleveland Bay is an excellent English breed suitable for the farm and road. There are a few other breeds which possess many good qualities and prove quite satisfactory for the general uses of the farm.

On account of the cost, and also the trouble and expense of keeping a stallion, most farmers will feel obliged to take their mares to one owned by some dealer, or large breeder of horses. There may not be just the breed of horses which he would

prefer near enough to his place to warrant his securing the desired blood. In such a case he must take the best which can be found or else buy a stallion of the breed which he prefers. Most farmers will choose the former course. Although there is a great deal more difficulty in obtaining, in country towns, a thorough-bred stallion than there is in finding a male representative of any particular breed of cattle which may be wanted, it is not unusual to find one which is well bred, which possesses a good, though not always perfect, pedigree, and which has the reputation of getting good colts. Then there are many more stallions without either pedigrees or any specially valuable

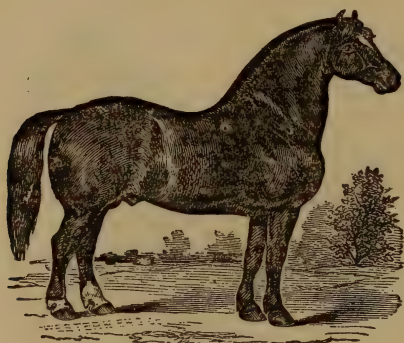


FIG. 94.—“ELDORADO.” 657.

Black Percheron-Norman Stallion. Imported from France, July, 1878
by M. W. Dunham, Wayne, Du Page Co., Ill.

traits. The cost of taking a mare to one of the latter class is much less than that of securing the services of the better ones. And as the mares which a large class of farmers use for this purpose are very poor, it is only natural that the services of the poorer class of stallions should be the most in demand. This breeding of worthless dams to miserable sires is a cheap way of obtaining colts, but the colts are still cheaper than the method which is employed to secure them.

While it is very important to have a good and sound mare, it is of equal, if not greater, moment to have an excellent sire. It is not necessary that the sire should be a thorough-bred, though if

he belongs to a race of horses suitable for the farm it is very desirable, but it is important that he should be well bred, and be able to transmit the excellencies which he has inherited. He should be sound and kind, of good size and appearance, and should possess the qualities which the farmer most desires his horses to have. It is a general, and probably a correct, impression that the strength and endurance of a colt, as well as his temper and disposition, are much more strongly impressed by the sire than they are by the dam. This fact should not lead the farmer to be less particular than he otherwise would be about the character of the mares from which he raises colts, but it should impress upon his mind the fact that it is *never* allowable to use a poor sire. If it is impossible to secure the services of a really good stallion, the farmer had better give up all idea of obtaining colts from his own mares. It is better to buy a good stallion than to hire a poor one. If he cannot afford to buy, and is shut up to the choice of hiring a poor one or none at all, he had better give up the horse business and raise some other kind of stock. Poor colts are a great deal worse than none, and the wise farmer will have as little to do with them as possible.

The mare usually goes with young from forty-seven to fifty weeks—sometimes not more than forty-four weeks, and occasionally as long as fifty-six weeks. It is very desirable, both for the benefit of the mare and the sake of the colt, that the foaling should occur when the weather is mild and there is an abundance of green grass in the pastures. The first half of the month of June is the best time for this purpose. During all the period in which she is with foal, the mare should be well fed and treated with extreme kindness. Blows, or even angry words, may cause her to slink the foal, and thereby sustain a great and permanent injury. She should have roots in the winter in connection with the best of hay. In the summer, she should have grass or green corn for part of her diet. During the period of gestation, light and regular labor will not only not be injurious but will

prove a positive benefit. Excessive labor should, of course, be avoided, and when at work the quantity of food which she receives should be increased. During the whole period she will need more and better food than she would under other circumstances, as she is obliged not only to sustain her own life but also that of the foetus. During the last few weeks of pregnancy, the mare should be worked only enough for exercise, and toward the last part of the time this should be very gentle. Many owners allow the mare to run in the pasture, and some allow the colt to be dropped there. While it is well to let the mare have some liberty, we do not think it best to leave her to bring forth her young in the field. When the time for labor, which when all goes well is short but very severe, approaches, she should be put into a large box-stall which is light and comfortable and the floor of which is deeply covered with straw. She should be treated with kindness, and no one except the owner should be in sight. Everything around should be kept as quiet as possible. In case of a wrong presentation, or any other difficulty, the services of an educated veterinary physician should be obtained as soon as possible. In nearly all cases, if the mare has been properly treated during the period of gestation, she will get along well at this critical period. Very young or very old mares, those which have been kept poor and over-worked, and those which have been united with males which, from their excessive size or some other inadaptation were altogether unsuitable, are the ones with which trouble is to be feared. It is of great importance that the best of care should be given, as it may save the life and health of both the mare and her colt.

CARE OF THE COLT.—If the colt is strong, as he will be likely to be if the directions given for the treatment of the dam have been followed, he will not require a great deal of special attention. It may be well to help him to get on his feet, and get a little used to standing up, but this is not absolutely necessary,

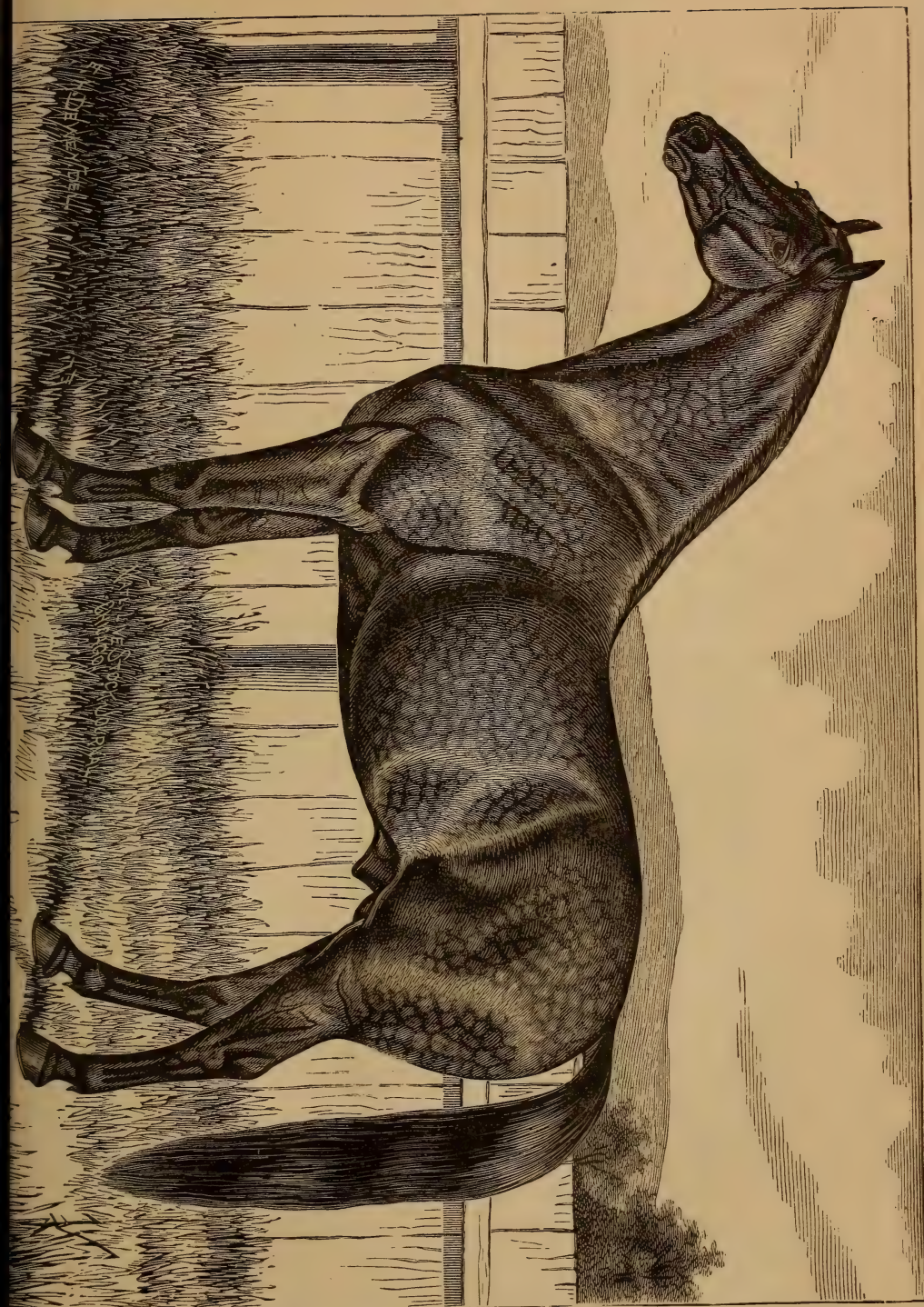


FIG. 95.—CLEVELAND BAY STALLION, BAY SPLENDOR. Weight 1,390 lbs., height 16½ hands.
Imported by George E. Brown & Co., Aurora, Ill.

and if the dam is restive, is not desirable. If the foal is weak, and can neither get up himself nor stand up when he is set upon his legs, he must be attended to at once. If let alone, he may in time get up, but he will be about as likely to die. If weak, he should be held up and his legs rubbed with a woollen cloth, which has been dipped in pretty warm water. After a little time they should be rubbed with a dry cloth and then with the hand. This in order to get the blood circulating well through the whole system, and especially to attract it to the extremities. The friction will also give strength to the muscles, and enable the colt, unless it is extremely weak, to soon stand alone. While this rubbing is going on, or at intervals during which it is ceased, the colt should be held up to the dam and allowed to obtain some milk. In a little while he will gain strength enough to stand alone. For a few days the mare and colt should be kept quiet. After this the dam may be put, gradually, to light labor. The colt may go with her if desired, though it is better to keep him in the stable or the pasture. It will be easier for the colt than it will to be chasing after the team, and he can be weaned with much less trouble than will be involved if he is allowed to go everywhere with the dam. He should be weaned when six or seven months old, but should first be taught to eat fine hay and oats and to drink water. It is best to remove him from sight and hearing of the dam, and if another colt can be put with him he will do much better than he will alone.

Now comes the critical time in the life of the colt, and it is for the owner to decide whether he shall grow into a strong, robust, and energetic horse, or into a weak and undeveloped beast. Good care and food are absolutely necessary if a good horse is to be grown from the colt now in hand. It will not do to leave him exposed to all the cold and snows of winter, or to the burning heat of the summer sun. In cold weather a warm shed should be provided in the daytime, into which he can go when he desires to do so, and a comfortable stable at night.

His food should consist of fine hay, a few oats daily, some roots which have been cut fine, and occasionally a little oat or rye meal. Pure water should be furnished in abundance. At this time it is possible to over-feed the colt, but the great majority of farmers err in the other direction. It is not well to stimulate the production of a large quantity of fat, but it is best to keep the animal growing, and feed him so that he will constantly be in good condition.

In the summer the colt should be turned into a pasture, in which there is plenty of good food and water and a shed which will give protection from the burning sun. It is not well to turn a colt into a pasture with cows or young cattle. Sometimes colts are hooked and spoiled by the cows, while at others the case is reversed and the cows are kicked and spoiled by the colts. Neither is it best to put a colt into a pasture alone. Two or more colts do much better in a pasture together than they do when kept separate or put into pastures with cattle.

During *all the period of the growth* of the colt he should have good food, good water, and the best of care. It will not do to take good care of him until he is two years old, and then make him shift for himself. From the hour of his birth until he is completely developed the formative stage extends, and any neglect, or any error in feeding, during any part of this time will certainly detract from the value of the animal when he is matured. If at any time the colt is badly kept he will surely be injured thereby, and he will carry the marks of that injury until his dying day. Once stunted the colt will be damaged for life. This may seem a sweeping statement, but it represents a truth which the vast majority of horsemen accept. Evidences of this fact may be seen everywhere. Sometimes a colt which has been poorly fed comes up into a pretty good horse. Such a thing is possible. But even here the rule holds good. The horse is better than might have been expected, but he is very far from being as good as he would have been if he had

received the care and attention which he deserved. If a man wants to bring a colt into a powerful and hardy horse, he must take care of him during all the time he is growing. The idea that subjecting an animal to hardship will "toughen" it is one of the most preposterous which ever entered the head of a man who was not insane. Does a general fortify a city by pulling down all of its walls? No. He goes to work and makes those walls as strong as the labor of his most energetic workmen directed by the skill of his ablest civil engineers renders possible. And the breeder who wants to make his animals strong and hardy must build up their constitutional vigor instead of tearing it down. He will find destructive forces enough with which to contend if he devotes all his energies towards strengthening the vital powers. The argument for exposure which many derive from the habit of the INDIANS of requiring their children to go barefooted in the snows, and depriving them of clothing even in the coldest weather of our NORTHERN winter, has no weight at all. This comparison of the hardy savage with the refined and educated white man is not at all to the point. The physical and mental constitution of the savage is altogether different from that of the civilized man. We might just as well talk of a frog as being "tougher" than a lamb. The argument also fails from the fact that the plan is not a success even with the INDIANS. The terrible mortality among their children does not offer much encouragement for other races to try the methods which yield such fearful results. Besides, as the INDIAN rises in the scale of manhood, he throws off these methods of slow torture and protects his children from, instead of exposing them to, the cold. There is no possibility of making a child or an animal better by unduly exposing him to extremes of temperature, or by keeping him on a short allowance of food. All the effects and tendencies of such a course are evil, only evil, and that continually.

CASTRATION.—In this country and in ENGLAND it has been

customary to castrate male colts when they were from six months to two years of age. Those designed for farm work are generally castrated at an earlier age than the colts which are to be used for carriage horses. Just now MR. BERGH, the world-renowned humanitarian, is attracting a great deal of attention by his efforts to induce horse-owners to omit this operation. He claims that the horse is not only no better, but is not nearly as good for being castrated, and that it is an abuse of power for man to perform the operation upon a helpless animal. He cites the fact that in ORIENTAL lands it is not performed, and asserts that there are no better or more tractable horses in the world than there. He is also confident that there is no necessity for castrating horses in this country. Much as we respect the gentleman who has advanced these views, and sincerely as we wish him success in his efforts to correct the abuses to which so many horses are subjected, we must dissent from his conclusion upon this part of the subject. In our younger days we had an idea that it was worse than useless to castrate a colt. But after being obliged to use a stallion a while for farm work we concluded that we had made a mistake. Stallions are utterly unfit for farm work, and should never be driven as ordinary carriage horses in cities and towns. They are neither safe nor desirable animals to use in these ways, and we consider it a wholly impracticable plan to allow all the male colts to grow up entire.

It is best that the operation should be performed at a rather early age, as it reduces the strength of the subject less, he does not struggle as violently, and is therefore safer and easier to handle, and the suffering is less than is the case with an older colt. While some farmers practice, and a few writers recommend the owner of the colt to perform, this operation, we cannot approve of such a course. On the contrary, we fully believe with that able writer on the horse, W. H. HERBERT ("FRANK FORRESTER"), that the operation of castration is "a very delicate

one, and should never be attempted on a living subject, except by a person of experience and skill." We consider it a great deal better, and in the end more economical, to employ an educated veterinarian than it is for the farmer to attempt the operation himself, or call in the help of a "horse-doctor" who has neither learning nor skill. The use of the old-fashioned hot-iron for searing the cords should be forever abandoned. It is terribly painful, and the improved methods now employed have rendered it altogether useless. Chloroform is sometimes administered, and by its means pain during the operation is entirely prevented. It is to be hoped that its use will become much more common.

Against one temptation we ought here to warn the farmer. When he has a promising male colt on his hands he is very likely to imagine, and his neighbors, if they are friendly, are quite apt to assert, that so fine an animal as this particular specimen ought to be saved for breeding purposes. In many cases this judgment is correct, but in the great majority of instances it is merely a question whether the owner will have an excellent horse or an inferior stallion. We have already alluded to the great importance of breeding only from male stock of established superiority. The question is not simply whether a particular stallion has desirable qualities, but, combined with this, is the still more important query whether he has received these good points from a long line of ancestors, and has them so firmly established that he can transmit them with a great degree of certainty. If this can be answered in the affirmative, the stallion which is unusually promising should be kept, and his powers of transmission tested. But if the stallion was got by an inferior horse, and brought forth by a mare of no recognized virtues, beware of keeping him for a breeder. His good points are merely accidental, and there can be no more certainty, and but little more probability, that he will transmit them than there would be that he would get splendid colts if he were as much

below the average as he now is above the common standard. The best thorough-bred horse, of a breed and form fitted for farm purposes, is the best one in the whole world for the farmer to use with his mares. If the services of a thorough-bred cannot be secured, then a stallion whose breeding has been very good should be obtained. The nearer he is to being "full-blooded" the better. We have no leanings toward the race-horse as such. We do not approve of racing. And we consider the breeding of horses for the track one of the most uncertain and unprofitable pursuits in which a man can engage. But for years we have made this subject of breeding a study, and we have been forcibly impressed by the fact that excellencies are to be transmitted, if at all, by animals which have received them from a long line of ancestors, and which have them so strongly developed that they will impress them upon their offspring. Those farmers who consider thorough-bred horses as good for nothing except for "fancy" and trotting, should heed the suggestion of MR. HERBERT that "not only is it not true that speed alone is the only good thing derivable from blood, but something very nearly the reverse is true. It is very nearly the *least* good thing. That which the blood-horse does possess is a degree of strength in his bones, sinews, and frame at large, utterly out of proportion to the size or apparent strength of that frame. The texture, the form, and the symmetry of the bones—all, in the same bulk and volume, possess double, or nearer four-fold, the elements of resistance and endurance in the blood-horse that they do in the cold-blooded cart-horse."

The same author, than whom there is no better authority, asserts that in point of muscular development, the construction of his respiratory organs, and the formation of his nervous system, the blood-horse has a still greater degree of superiority. In proportion to his size and weight the thorough-bred horse possesses greater vital power, strength, and endurance than any other animal. Not only is he superior in himself, but he has

the power, when united with a sound and well-formed female, of imparting these excellencies to his colts. The man who takes a good mare to a good thorough-bred horse has a reasonable degree of certainty that he will secure a colt of great excellence. But if he takes the same mare to a stallion in whom these good qualities are lacking, or are only accidentally present, he will be almost sure to obtain a colt of no special value. Therefore, we are strongly in favor of using only the very best of males for perpetuating the race of horses. And it is on this account that we advise the farmer not to keep for breeders the colts which, though accidentally good themselves, came from a low and inferior parentage.

NICKING AND DOCKING were formerly practiced almost universally. The former process is now unfashionable, and it is to be hoped will always remain so. It is a barbarous operation, causes a vast amount of inconvenience to the animal and much severe pain, and does no possible good. It disfigures a horse, and ought to be prohibited by law. DOCKING is still followed to some extent, but is going out of date. We shall not describe the method, as we consider it a useless, cruel, and unjustifiable operation.

BREAKING AND TRAINING.—Much of the difficulty which is so often experienced in breaking a colt is the result of neglect and careless usage. It is true that some colts are naturally vicious and cannot be easily managed. Such animals should not be kept upon the farm, but ought either to be killed outright or else put upon the stage or horse-car routes, where the labor will be constant and severe, and the animal will be kept in proper subjection. There are, also, some men who can train a colt much more successfully than others. They have a high degree of skill, much of which is usually inherited, and possess a peculiar aptitude for this work. Some men acquire quite a degree of skill who have no natural talents in that direction. But it is not every man who is fitted to break a colt, and the one who is

unqualified had better let him alone. His attempts will be pretty sure to make the colt worse and may prevent his ever becoming a good and well-trained horse. In order to manage the colt aright a man needs an unfailing stock of patience and must be uniformly kind. One harsh word may frighten the colt and cause an injury which can never be repaired. The farmer may, and should, give the first lessons, but we think it wise to employ some kind, experienced, and skilful horseman to give the finishing touches to the educating process. This may seem a needless expense, but it will be the means of greatly improving the character and appearance of the animal, will add very much to the comfort and safety of those who use him, and will largely increase his selling price. A great many farm horses which are kind animals and good to work are so awkward and ungainly that it is a trial to drive them on the road. They have never been half-trained, and their habits are now formed so that they never will be. But the colt can be trained well, and it is important that he should be, at least, fairly educated.

The educational process should commence early in the life of the colt. Familiarity with man is one of the first lessons to be learned. There should never be any harsh language used to or around him. He should be frequently fed from his owner's hand, and often petted and caressed. When only a few months old he should be taught to lead and to be tied up. Nothing should be done which will awaken the emotion of fear. A frightened colt is a seriously injured animal. It is necessary that the colt should realize that man is his master, but he must also understand that he is to be ruled by kindness and not by violence. He must learn that man is his superior, but this lesson must not be enforced by blows or any other severe method. The colt should not only be led around and tied with a halter, but should have his feet taken up and be taught to lead by the forelock. He should learn to carry something on his back. A strap with a thick pad may be buckled around him at first, and

larger things put on after he has got well used to this. Care should be used to put on something which the colt cannot possibly get off by his own exertions. It should be put on so gently that it will not scare him, but so firmly that it will stay there until the trainer sees fit to remove it. Many colts have become confirmed in a very bad habit by being allowed to shake off something which was laid upon the back. A few lessons will make a colt quite expert at this business and may get him so that he will never be safe for a man to ride.

In all the processes of breaking and training the colt should never be allowed to obtain the slightest advantage. Uniform kindness and uniform mastery should never be separated. The man must never, for a single moment, allow the colt to imagine that he is stronger than his trainer. If care is taken never to frighten him, and never to get angry with him, there will not be much difficulty in this respect. But it should always be remembered that anger is a sure sign of weakness, and that the colt will be very likely to profit by any exhibition of it which his teacher may make. Harnessing should not be attempted all at once, but should be effected by degrees. A few straps should be put on at a time and the colt allowed to get accustomed to them. Then a few more may be added until the whole harness is used. When not more than one or two years old the colt may be harnessed by the side of a horse and gently driven around. As he grows older and gets used to going in the harness the pair may be attached to a light wagon. When this lesson has been well learned the colt may be hitched into a single wagon and taught to drive alone.

One thing which a colt should always be taught is to back. This is often neglected. In order that he may learn this lesson easily the colt should be taught when very young to step back by the word of command and a slight pull upon the halter. When he has learned to go in the harness, this lesson should be repeated, using as a signal a light pull on the reins. After

being well taught to draw light loads he should be attached to a wagon and taken to some natural incline where the wagon will of itself tend to run down hill. Here he can easily be made to understand the lesson which is then in hand. When he will back readily down an inclined plane he may be tried on level ground, and, in time, a light weight may be laid upon the wagon. The weight should be gradually increased as the colt learns to back.

A very common error in the training of colts is the drawing of their heads too high. The effort is made to induce the animal to hold up his head and yield to the pressure of the bit in his mouth. Some horses are so formed that they cannot carry their heads high, and the effort to force them to do so is as unmerciful as would be an attempt to compel a child to walk upon its heels or in any other unnatural position. No biting harness should be put on until the colt is well used to the bit, and then the check-rein should allow him to carry his head in the natural position. If the head is carried too low, a gradual shortening of the check will, in a year or two, make a marked improvement. But this shortening must be only a very little at a time, and should never be carried to an extreme. If it is not natural for the horse to carry his head up let him hold it down. A tight check is an injury and an abuse. The mouth soon becomes toughened by the strong and constant pressure of the bit, so that the horse cannot be easily reined, and he is made to suffer an immense amount of pain by means of this unnatural and inhuman method of treatment. Instead of the old style biting harness, some good trainers place the colt between two pillars in the stable and have straps from the rings of the bit attached to rings in these standards. Only a very light strain is put on at first, and it is increased only as the progress which the colt is making seems to require. This is a much safer method and much easier for the colt than the use of the biting harness.

THE AGE FOR WORKING a colt will vary somewhat with his strength, size, and disposition. There is no doubt that the majority of farm horses are put at work too young. Frequently at four years of age the labor of a full-grown horse is required. We are well aware that it is pretty expensive keeping a four-year-old in comparative idleness, but we believe that it will pay a great deal better than it will to put him to hard work. At this age he has not attained his full size. His bones are still growing, and his muscular development is not complete. Relatively, he is in a condition similar to a large boy. If size were the only criterion we should say of many a boy of fifteen years of age that he could do the full work of a man. But every one knows that for a boy to do a man's work for any length of time is utterly ruinous. The same principle applies fully to the case of the colt. Light work will be beneficial, but hard labor can only result in permanent injury. If a colt is worked hard he will become an old horse when he should be in his prime. The ordinary horse is not capable of doing full work without being injured until he is about six years old. If farmers were willing to wait a little longer before securing the reward for their labor and pains they would receive a great deal more in the end. Their horses would be much better and would last several years longer than they do when hard work is required of them in early life.

FEEDING HORSES.—There are not many ways in which farm horses are so often and so seriously injured as they are by improper feeding. And this injury is almost always inflicted unintentionally and ignorantly. Nevertheless its effects both upon the health of the horse and the financial condition of the owner are anything but satisfactory. A great many unsound farm horses are said to have worked too hard, and this is the reason which is usually given when inquiry is made concerning the cause of the disease. In a few cases, and only a few, this is the true and only cause. In the vast majority of cases hard

work in connection with improper feeding has done the mischief. If the horses had been carefully fed, they would have done all the work which has been required of them, and still have remained sound. We have already alluded to the fact that the hours of labor of the farm horse are very irregular, and that, on this account, he is fed at irregular intervals. This unsystematic feeding is the prolific source of great evils. It leads directly to indigestion with all its attendant disorders. Its indirect results are also bad in themselves, and pave the way for those which are still worse. Now at all times, and especially when he is at hard labor, the horse should be fed with the utmost regularity. He should have food three times a day, and these times should be the same one day that they are another. If he is working hard he should receive a better quality of food, but should not have it more frequently than he does when he is idle. This is the general rule, to which there may be a few but only a few exceptions. But it is a rule which the majority of the owners of farm horses never attempt to apply. Too many farmers feed their horses when and as they happen to find it convenient. When they first go to the barn in the morning they throw a lot of hay into the mangers, and perhaps give a few quarts of meal to each horse. When they go to turn out the cattle, if the horses are in their stables, another lot of dry hay is given them. At noon the manger is filled up again. When the cattle are put up at night, at milking time, and when the owner feeds the cattle in the evening, the same process is repeated. If the horse happens to be in the barn, he is kept eating hay a good share of the time from morning until late in the evening. He is fed just as though he were a cow, with the exception that he receives a larger quantity of food. But some days he is required for work. Then he is not fed nearly as often and receives much less food. It would naturally be supposed that the days when at work the horse would need more nourishment than he does when doing nothing. But the quality of his food

is not changed, and he really obtains only about half as much of it when at work as he would if standing still in his stable.

Not only does irregular feeding prove very injurious in that the horse is not fed at all according to its needs, but the bulky food which is given also works a great deal of mischief. A horse which is fed in the manner above described is never in a condition to work either easily or safely. When stuffed full of dry hay, often smoky hay at that, a horse is no more fit to work than is a gluttonous man at the close of a three days' feast. While in this condition he cannot safely draw a heavy load or travel much faster than a walk. His lungs have not room in which to expand, his whole digestive system is overloaded and clogged, while all the nervous energies are weakened and depressed. In this condition multitudes of farm horses are taken from their stables for drives and also for hard work. And it is because they are used when in this condition that so many farm horses have the "heaves" and various other diseases. A good authority has asserted that at least one-half of the diseases to which the horse is liable are directly caused "by bad food, or good food badly administered."

In order to feed a farm horse so that he can work safely and comfortably, it will be necessary to give less hay and more grain than most farmers furnish. The hay should be cut and moistened with warm water. If meal is fed, it should be sprinkled upon and mixed with the cut hay. If oats are used instead of meal, they may be given with the hay or after it has been eaten. The feeding should be regular and no dry hay should be furnished between meals. When the horse is hard at work, the quantity of meal or oats should be increased, but no more hay should be given than usual. A few roots will be a good addition to the diet. Carrots are specially beneficial. After extreme hard work, a warm mash may be given with benefit. Still, it is not best to drive or work horses up to the

point of exhaustion. It will certainly injure and may spoil them. Pure water, in a clean pail, should be given in moderate quantities at least three times a day. The horse is very sensitive about the quality of the water which he drinks, and it is an abuse to make him take it from a dirty pail. The pail used for watering the horses should be kept just as clean as the one used in the house for holding the water which the inmates drink. The horse should not be put to hard work for an hour after he has finished eating, and should always have at least an hour in which to rest at noon. He should never be fed, nor freely watered, when either hot or exhausted.

New hay, new oats, and especially new corn, should never be fed to a horse except in very small quantities if anything better can be obtained. The habit of some farmers of feeding soft corn to horses is extremely bad, and this practice has caused the death of many valuable animals. Old corn is very much safer, and is better in every respect. For most horses oats are better food than corn. They are not as heating, and are easily digested.

When a farm horse is required to go a journey, he should be allowed to take his own time for its accomplishment. He ought not to be hurried. Travelling is very different from the work to which he is accustomed, and it will be likely to prove very wearisome. The majority of farm horses are not natural travellers, and their habits and education, as well as their tastes and inclinations, absolutely unfit them for fast or long continued driving. If it is necessary to go a long distance in a day, it is best to feed two hours before the horse is wanted, take an early start, and drive moderately until ten or eleven o'clock. Then stop for two hours. Let the horse be unharnessed, curried, rubbed well with a stiff brush or a woollen cloth, and then allowed to stand half an hour and rest. He may then be fed with a liberal quantity of clean oats. At the expiration of the two hours from the time of stopping, he may be started on

the road, but for the first hour or two should be driven slowly. If the point of destination is not reached early in the evening, the horse should be again put in a stable and treated as before. After a good rest he may be driven a few miles farther. Upon reaching the end of the journey, the horse should be thoroughly cleaned and rubbed, put in a comfortable stable, and allowed to rest for an hour. Then he may be supplied with food and water and left for the night. While on the road it is well to give the horse water, in small quantities, several times during the day. It is not well to drive the farm horse after he has had his supper, and it should only be done in a case of importance. If he has travelled all day, he has done enough, and should be given the evening and the night for rest.

When at work on the farm, horses need more care and attention than they usually receive. Not only should their feeding and watering be carefully arranged, but they should be kept clean and comfortable while in the stable. After working in the mud their legs should be washed clean, wiped, and rubbed until dry. We are not much in favor of blanketing farm horses. If the stable is comfortable, it is not necessary; while if it is cold, the blanket does not give the desired protection. The difficulty with a horse that is cold is to maintain a uniform circulation of the blood. If this could be effected, the trouble would wholly cease. But the blood does not go freely to the extremities. Put a blanket on the body and the blood is still more strongly thrown to the chest. The extremities needed the blood. There was already too much in the body and the internal organs. Blanketing under such circumstances is liable to cause congestion, and may lead to very serious results. Again, the horse that has a blanket in the stable is sure to feel the cold more severely when he is out of doors. He is often required to stand around in the cold after having been worked or driven. *Then* he needs a blanket, and it should always be put on. But a blanket is not needed in a suitable

stable—except for a while after the horse is put in, tired and exhausted—any more than a man needs to wear an overcoat while sitting in the house. Of course, if a horse has become accustomed to being blanketed in the stable, he will need to have the practice continued. But in the case of a colt, we think it better that he should be kept comfortable by being in a warm stable rather than by wearing clothing. It is a common opinion that blanketing will make the hair lie smoother and give a finer appearance to the “coat” of the horse. But experience has proved that in order to make much improvement in this direction the clothing must be extremely warm. This will often prove injurious. But the same end can be secured, not only without injury but with positive benefit, by rubbing the horse thoroughly every day, and being careful to keep him perfectly clean. Blanketing for the mere sake of appearances should not be performed.

THE STABLE.—The character, value and efficiency of a horse will very greatly depend upon the condition of the stable in which he is kept. We are sorry that it is so, but it is a fact that three-quarters of the stables in which farm horses have their homes are utterly unfit for the purpose, while many of them are not good enough to be inhabited by hogs. The horse has very delicate sensibilities, and is easily injured in many ways. Nearly all stables are too low, and the doors leading to them are both low and narrow. When a horse is startled by any unusual noise, he is almost sure to throw up his head. If he strikes it against the beams, or the floor above, he will receive a direct and very likely a severe injury. This will frighten him still more, and the more he is hurt and the more frequently he throws up his head, the worse he becomes. Many good horses have been ruined by this habit, and the injuries thus received. No horse-stable should be less than nine feet between the floors, and some writers recommend twelve feet.

The doors should be so wide and high that the horse can go in and out with a harness on, and not touch the sides. We have used a horse which was gentle in other respects, but which would plunge like a tiger out of his den when he was led out of the stable door. He had at some time been frightened by being led through a narrow door, and had got so that it was difficult to get him through a wide one without injury to himself and the man who was leading him. We tried for years to conquer the habit, but did not succeed.

The ground outside of the stable should be nearly level with the floor on the inside. There are stables in which the floor is from one to two feet higher than the ground. Such stables are very inconvenient to all horses, and positively dangerous to mares which are with foal. Many cases of sprains and lameness can be traced directly to these high steps, and many horses which go in and out of the door as if they were afraid of some severe injury, were brought into this habit by the same cause.

The horse-stable should be both light and warm. Too many horses are kept in dark stables. This is very unpleasant, and also injurious. The sense of vision is soon injured, and in some cases is destroyed. Much suffering is also caused to the horses by taking them from dark stables into the full glare of the strong sunlight. The cost of windows which will lighten the stable will be slight, and ought to be cheerfully incurred. Warmth should be secured by boarding the frame of the stable outside and inside, and filling the space between the boards with tan-bark or dry sawdust. Warm stables are not only more comfortable, but also more healthful than cold ones. Standing in a draught of cold air when warm and tired often induces serious disease. The cost of keeping will also be much less in warm stables than it will in cold ones. The whole barn should be well ventilated, and plenty of pure air furnished for the horses.

Another requirement is that the stables shall be kept clean.

In many stables there is a strong ammoniacal odor. This may be prevented by cleanliness, and the use of plaster each day sprinkled over the floor. Whenever this odor can be detected, there is abundant evidence that the stable is in an unhealthy condition. Allowing the horse to stand upon large piles of wet litter and fermenting manure is a prolific source of disease. The horse is naturally a clean animal, and will neither be comfortable nor remain long in health if kept in a filthy stall. Twice every day the stable should be cleaned and dry litter supplied.

SHOEING THE HORSE we consider a sort of necessary evil. When badly performed, by ignorant and brutal smiths, it causes various diseases of the feet, and sometimes spoils the horse. There are writers who advocate the disuse of shoes, but such a course seems hardly practicable. In the NORTH, during the winter, sharp shoes are necessary. Without them the animal is in danger of frequent accidents. In warm weather shoes are almost as necessary in all places where the land is stony and rough. There may be a few horses which can go in the summer without shoes, but the great majority have too tender feet, and will need to be shod. As to the method of shoeing we shall have little to say. Each smith has his own ideas upon the subject, and if he has learned his trade thoroughly, he is supposed to know more about it than the farmer. It does not seem to be just right for the farmer to give instruction to the man who has studied a subject of which he has no practical knowledge. Still there are many ignorant smiths—men who know less about the structure and needs of the feet of a horse than they do about physiology, of which they know nothing at all. Such men should never be allowed to shoe a horse. But there are many good shoers, men who are kind, and work intelligently. They are the ones who should be employed. To shoe a horse well a man needs knowledge and experience. Any one can shoe a horse badly, but there is danger that the

bungling work of an ignorant shoer will ruin the horse. As to exact methods scientific workmen are not fully agreed. Therefore it must not be taken for granted that a man does not shoe well because he does not follow the plan of some other shoer who was known to be good. But when a smith does not use common sense, when he is harsh and brutal, and when horses are lame or go badly after he has shod them, there is sufficient evidence that some other workman should be employed.

DISEASES OF THE HORSE.—To treat fully of the diseases of the horse would require a whole volume, and should be the work of an experienced veterinarian. Some work upon this subject should be in the hands of every man who owns a horse. DADD'S MODERN HORSE DOCTOR, LAW'S FARMER'S VETERINARY ADVISER (treating also of diseases of cattle, sheep, and swine) are both excellent books. There are, also, many others which possess a great deal of merit.

To treat a sick animal safely and successfully requires not only a knowledge of the name of the disease with which it is affected but also a clear understanding of the whole animal structure, of physiological laws, and of the uses and various action of remedies. When a horse is merely out of health, he should be carefully fed and allowed to rest. When he is attacked by an acute disease, a veterinary physician should be sent for at once. Delay will be dangerous, and the administration of powerful remedies by the farmer or by some ignorant "horse-doctor" will be likely to make a cure utterly impossible. For farmers who are far removed from a good veterinarian we recommend the purchase of the sets of remedies, which are put up by HOMŒOPATHIC physicians of acknowledged ability and skill, for the various diseases to which the horse is subject. With each set there are full directions. The quantities required are small and the sets are not expensive. They can probably be obtained of wholesale druggists in any of our large cities.

There are a few diseases for which a description of the remedies which are commonly employed by those who keep no stock of medicines on hand should be given.

OF THESE, COLIC is one of the most violent and dangerous. It comes on suddenly, the pain is very severe, there are intervals of rest, and the horse remains strong and is usually very violent in his movements. It is important that remedies should be given immediately. If attended to at once the following treatment proves beneficial: One tablespoonful of chloroform mixed with a gill of whiskey and a pint of warm water is to be given. Then inject a pint of warm soap-suds. If the chloroform cannot be had, use a pint of very warm water in which as much salt as possible has been dissolved. In case the treatment has been long delayed, bleeding must be resorted to before the above remedies are given. The medicine can be given by means of a long-necked bottle, though a drenching-horn is better. For bleeding, a fleam should be used, unless the one who attempts it is a practiced surgeon, in which case a lancet may be better. The horse must be blindfolded on the side from which the blood is to be taken. Then at a point on the neck, about two inches from the angle of the jaw, the jugular vein should be found, the hair moistened and smoothed and a gentle pressure applied with the fingers of the left hand in which the instrument should be held. The vein will enlarge at once. The edge of the fleam is to be placed in a direct line with the course of the vein and over its centre. It may be struck with a stick, or the fist, but the blow must not be so hard as to cut the opposite side of the vein. A good-sized blade should be used, as a small quantity of blood drawn quickly is more beneficial than a larger one which flows slowly. When a sufficient amount of blood has been taken, the edges of the wound should be brought exactly together, a small, sharp pin passed through to keep them in place, and a few hairs from the mane of the horse wound around the ends so as to completely cover the wound.

The horse must then be fastened so that he cannot rub the wound. In twenty-four hours the pin may be carefully withdrawn. Such are, substantially, the directions given by the celebrated YOUATT for bleeding the horse. There are times when bleeding is necessary, but in the great majority of cases it is injurious. The blood is equivalent to the life, and its withdrawal must have a very depressing effect upon the vital forces.

Very similar in many of its symptoms to colic, and sometimes mistaken for that disease, is INFLAMMATION OF THE BOWELS. There is this difference, however, which will enable any careful observer to distinguish between them. In an attack of colic the legs and ears are of the natural temperature, relief is obtained by rubbing the belly, and from motion, there are intervals of ease, and the horse retains his strength. But in a case of inflammation of the bowels the legs and ears are cold, the belly tender and painful to the touch, there is constant pain which is increased by motion, and the strength is greatly diminished. For inflammation of the bowels bleeding must be resorted to at once. Six or seven quarts of blood may be taken at first, and, if relief is not soon obtained, two or three quarts more should be drawn. Injections of thin gruel in which half a pound of epsom salts, or half an ounce of Barbadoes aloes, has been dissolved should be given. Warm gruel should be given for drink, and once in six hours warm water with a drachm or two of aloes. The belly should be blistered with tincture of cantharides, and the legs kept warm by rubbing and bandaging. For a few days the horse should be kept on gruel and bran-mashes. As he gets better he may be very slowly returned to his oats and hay. This is a very violent and dangerous disease, and we do not recommend the farmer to treat it when a competent physician can be obtained. But there must be no delay, and the owner may very properly bleed the animal and give injections while his hired man is gone for the doctor.

COSTIVENESS is not immediately dangerous, but it leads to

many diseases which sometimes have a fatal ending. Mild cases can be readily subdued by feeding roots and giving bran-mashes. Obstinate constipation will require more powerful action. Aloes is the best—indeed, HERBERT declares it to be the only safe purgative for a horse. It should be new, as it loses its strength by age. Its administration should be preceded by the use of bran-mashes for two or three days—these being the only food which the horse is to receive. After this preparation, a light dose, four or five drachms, of aloes will be very effective. Aloes may be mixed with olive oil and molasses into the form of a ball, which the horse can be made to swallow as follows: Tie the horse in the stall with his head well up, draw the tongue out gently with the left hand, and hold it there by pressing the fingers against the side of the lower jaw. “The ball is then taken between the tips of the fingers of the right hand, the arm being bared and passed rapidly up the mouth, as near the palate as possible, until it reaches the root of the tongue, when it is delivered with a slight jerk, the hand is withdrawn, and the tongue being released, the ball is forced down into the œsophagus.” If it does not pass immediately down the throat, which can be readily seen by watching the left side, a light tap under the chin will cause the horse to swallow it at once. It is not well to give either castor or linseed oil alone to a horse. Olive oil is very inefficient. Salts frequently prove of little power, except in doses which render the medicine almost as dangerous as the disease.

WORMS often prove a source of irritation to a horse, and in large numbers are quite injurious. To remove them, give a ball containing two drachms of tartar emetic, one scruple of ginger, and molasses and linseed oil enough to get the materials into good shape for administration. One of these balls should be given every other morning half an hour before the horse is fed. Only a few doses will be required. We have known saleratus to be used with success even in bad cases. A

teaspoonful given with the cut feed each morning will be likely to effect a cure in from one to three weeks. Simpler than either of the above remedies, and much to be preferred if it will prove efficient, is the plan of keeping the horse for three or four days upon corn-fodder. If the ears are not all taken off, it will be all the better. No other kind of food should be given, and the horse should not be worked or driven hard while kept in this manner. We had no faith in this remedy, but, after witnessing its good result in a case which had obstinately resisted the ordinary remedies, we must say that it is worthy of a fair trial. To remove the small worms which irritate the large intestine, an injection of an ounce of aloes dissolved in a pint of warm water will be useful.

Stoppage of the water can usually be remedied by giving sweet spirits of nitre in one-half ounce doses. In mild cases only one dose will be needed. If this proves ineffectual, repeat in a few hours. Should this fail to give relief, and the animal is in considerable pain, a competent veterinarian should be called at once.

We do not think it necessary to describe all the diseases to which the horse is liable, or give a list of all the remedies which are used therefor. Except in the manner already indicated, the farmer is in no condition to doctor a horse that is sick. He can give the HOMŒOPATHIC remedies to which we have referred, or pursue the treatment specially indicated for the particular diseases we have named. But unless he has read much upon the subject, he is not qualified to treat acute diseases, and his experiments will usually make a bad matter worse. The horse-owner needs to have, and to study, some book devoted specially to the diseases of the class of animals in which he is interested. And we feel the more strongly disposed to pass this point lightly from the fact that if the directions which we have given for taking care of, and feeding, working and driving, are followed, but very few horses will get out of health. We fully

believe, with a writer already quoted, that, "if a horse be of good, sound constitution, and be judiciously fed, regularly worked, warmly yet not too warmly clothed and stabled, in a building properly ventilated and aërated; and, above all, if he be kept scrupulously and religiously clean, there will for him be but little need of medicine of any kind." In the vast majority of cases, the loss occasioned by the sickness of a horse is a direct tax upon the owner for his want of care and skill in using and feeding. Accidents excepted, a good horse can almost invariably be kept well and strong if he is properly managed and cared for.

We ought not to close this chapter without a few words upon the treatment of old and disabled horses. It is a custom altogether too well established for the farmer to keep a good horse until he gets well along in years and then sell the faithful creature to a jockey, who will trade him to some one of that large class of men who are too poor to own a good horse, but who always keep some half-starved animal which they both abuse and neglect. Many a noble horse after a long life of patient toil, which has fairly earned for him the right to an honorable discharge, has been traded around by jockeys and idlers, and been compelled to drag out a miserable and painful existence. It is absolutely cruel and unjust for a farmer to treat the animals which God has given for his service in such a manner. The few dollars which are obtained in such a case are the price of cruelty, ingratitude and neglect. This course has often been pursued thoughtlessly, but even this fact cannot be considered a valid excuse. We hope the custom will not long be tolerated. Let the jockeys understand that when a horse has faithfully served his master through a long and useful life he is not to be put into their hands. Let the horse perform labor adapted to his strength as long as it pays to keep him. Then get some good marksman to lead him into a field, and with a well-directed rifle-ball end his days in a quiet, decent and painless manner.

Give the body a decent burial, and consider the approval of conscience worth infinitely more than the few dollars which some brute of a man would have paid for the noble horse.

THE MULE.

IN this country the mule has not yet become a very popular animal. Though there are, in all, a great many mule teams, they are very few when compared with the horse teams. There is a strong prejudice against the mule, but he is winning his way in the SOUTH and WEST, is frequently found in the MIDDLE STATES, and occasionally in NEW ENGLAND. Although he has some peculiarities which sometimes make him unpleasant to handle, he also has some positive merits—enough to justify a brief consideration of the animal in this work.

It is not every man, even though he may be pretty intelligent, who can tell just exactly what a mule is, and whence he sprung. The parentage of the mule and the hinny is, to many people, rather obscure. The mule is the offspring of the male ass, usually called a jack, and the female horse or mare. The hinny is the offspring of the male horse or stallion, and the female ass. The mule resembles the ass in form, temper and voice, though often larger than either parent. The hinny resembles the horse in all these respects much more closely than the ass. The hinny has certain merits, but they are not equal to those of either the horse or the mule, and it is not a profitable animal to breed in this country. Neither does it pay to keep the ass for any purpose except to cross with mares. Not, by any means, because the ass is a worthless animal, but because there are other kinds which will be more profitable.

The mule is a hybrid, and cannot breed either with its own or with other classes of animals. This is the almost invariable rule. Consequently it is necessary either to breed or import the

ass in order to keep good the stock of mules. It has been a common custom to use anything in the shape of an ass, no matter how inferior, for breeding purposes. This has proved very injurious to the quality of the offspring, and is a practice which ought to be speedily reformed. Some breeders have made a move in this direction, and have been well rewarded. Probably it will be better to grow breeding stock here than it will to import it from foreign lands. It has been thought by competent judges that by selecting the best from the stock now on hand, or by importing a few fine animals, and using care and skill in their mating, and the development of their offspring, "a superior jack to any now existing for AMERICAN breeding purposes" might be secured.

In all cases the best jack which can be obtained should be used. The quality of the jack seems to have a great deal more to do with the character of the mule than that of the mare. A fine jack and a decent mare will almost invariably produce a better mule than a merely passable jack and the finest mare which can be found. Consequently it pays well to obtain a first-class jack, but it is a great loss to use fine-blooded mares for the production of mules. A mare possessing superior blood should be used for breeding horses, if anything. If coupled with a jack she will bring forth a mule which will never be worth half as much as a colt from a good stallion, and the connection with the jack will be very likely to prevent her ever giving birth to a pure colt. If bred to a stallion after having produced a mule, the mare will be almost sure to have a colt marked, to quite a degree, like the ass. This fact alone should be sufficient to deter owners of superior mares, from which they hope some time to obtain colts, from breeding them with the jack.

A good, medium-sized mare, that has done service on the farm, and proved a good worker, should be chosen. Extra size is not desirable, and a bad temper, or any tendency toward a

vicious disposition, is a full disqualification. The best blood to be sought in a mare is the NORMAN. A half-blood mare of this stock, or even a good CANADIAN, if used with a first-rate jack, will be very likely to bring excellent mules. But the absence of this, or any other particular, blood need not be considered as excluding a mare from this use. If she is really good in temper and for work, sound, and of suitable size and form, she may be made available for this purpose.

We have treated of this point more at length than we should have done if the common practice had been more nearly correct. Breeding lies at the very foundation of the business. A mistake here will be permanent in its effects. If any kind of a mare, no matter how poor, is bred to any sort of a jack, there will be no reasonable ground for expecting anything very good from their offspring. But if men want mules at all they want good ones. They can raise good horses, and had much better do it than to spend their time and invest their capital in the effort to secure a poor class of mules.

When fully matured the mule is a remarkably hardy animal, but in his earliest years he does not seem to possess this excellent quality. While young he needs as good care as the common colt. The custom of keeping the mule colt half-starved is to be strongly condemned. He does not need corn and oats as much as the horse colt, but he should have good hay in abundance, plenty of pure water, shelter from storms, and protection from great extremes of temperature. While pampering would prove injurious, good feeding will be well repaid. If castration is to be performed, it should be attended to early. This is very important—much more so than in the case of the horse. It should be done before the mule is six months old, and it will generally be better to attend to it as soon as the subject reaches the age of four months. The operation should be performed with the same degree of care and skill which has been advised for the colt. A good mule colt, from good stock,

should be fully as valuable as a horse colt, and the same degree of care ought to be taken to keep him from injury, and make him useful.

BREAKING AND TRAINING.—As the mule is not, ordinarily, used for travelling on the road, he does not require as complete a course of training as the horse. But *as far as it goes* the education should be as thorough as possible. The mule need not be taught as much as the horse, but what he is taught ought to be perfectly done. Here is where the great trouble with the mule is usually found, and it is on account of the neglect of this principle that he has obtained a bad name. Let the same treatment be given the horse for ten generations which has been given to the mule during the same period, and at the end of the course the horse will be as ugly as the mule is at the present time.

Not merely for generations but for ages the ass has been abused and neglected by those whom he has faithfully served. It is not strange that this treatment has had a bad effect upon his character, and made him obstinate, with a strong inclination to be vicious. But he is not as bad as might have been expected, and will almost invariably yield to kind treatment if it is given early and uniformly. Except when the parents are vicious the mule colt will be pleasant, and if treated as kindly as has been advised for the horse colt will never show an ugly disposition. Handle him early and often. Begin before he is an hour old and accustom him from that time to be handled and talked to. Teach him to lead, to be tied up, to have things put upon his back, and to feed from the hand of the owner. *Never* get out of temper and never yell at him. Show him that you are friendly and have no desire to hurt him. Be careful not to frighten him, and never give him any occasion to distrust his trainer.

In this way the mule can be taught almost as readily as the horse. But the men who use only a club or a whip will

find considerable opposition. They ought to. When a man becomes a brute and attempts to cope with animals on their own ground he places himself at a great disadvantage. He not only demeans himself but the violence of his methods makes it impossible that he shall be successful. The mule colt which is always kindly treated will grow into a kind animal, but the one which is always abused will be obstinate and may become dangerous.

The points of superiority of the mule over the horse are greater physical strength and the ability to perform an immense amount of labor. The mule is a longer-lived animal than the horse, and will endure hard labor twice as many years. He can endure greater extremes of heat and cold, it costs less to keep him shod, and, while he ought to be well fed, the expense of keeping is very much below that of the horse. On these accounts he is, if properly treated, a valuable animal for use on the farm.

CATTLE.

TO mankind in a civilized state cattle are absolute necessities. They utilize a great amount of material which would otherwise be wasted, perform a great deal of labor, and furnish an immense amount of food. They supply many pressing wants of the individual, and add largely to the national wealth. The income now obtained from cattle in this country is very large, and by judicious management can be greatly increased.

By means of careful selection carried on for a long series of years a great improvement in the character and appearance of cattle has been effected. In this way several distinct and valuable breeds have been formed, and their representatives have been sent to all countries in which the live-stock interest is largely developed. The principal improved breeds which are

kept in this country are the SHORT-HORN, Ayrshire, Jersey and Devon. There are also many animals belonging to the Hereford, Dutch, Holstein, Alderney, and Guernsey, and a few of the Swiss, Brittany and other less common races. Each breed has certain characteristics which are strongly marked, and which separate it clearly from any and all other races. Each one has, for a long time, been bred with reference to the permanent establishment of certain qualities which their owners have desired to perpetuate.

To discuss the question which is the best breed would be an utter waste of time and space. Probably there is no really best breed, *i. e.*, a breed that everywhere and under all circumstances will prove better than any other with which it comes in competition. One breed is best for certain places and purposes, while for opposite conditions another will prove much better. The most zealous advocate of the Jersey cattle would not think of favorably comparing them with the Short-Horns for beef. And it is no discredit to the Jersey stock that it is inferior in this respect. The race has been bred carefully and skilfully for its milking qualities, and the desired end has been secured. The man who wants beef should not buy Jerseys, but if he wants rich milk and nice butter, he will be pretty sure to obtain them from cows of this breed.

As it is impossible to get the heavy farm horse and the fleet carriage horse in one animal, so it is useless to attempt to get extraordinary excellence in the two diverse departments of flesh and milk in any one breed of cattle. The two qualities are, in a measure, antagonistic and cannot be combined, in perfection, in any one race of animals. Therefore, instead of attempting to decide which is the best breed of cattle, we will describe the various characteristics of the breeds now common in this country, and endeavor to point out both their excellencies and their defects so that the individual farmer will be able to choose intelligently the one which will be the best for him to keep.

We shall not give the historical matter which generally accompanies such descriptions. What the practical farmer wants to know is not who bred a cow of a certain name to a particular bull one hundred years ago, but what are the merits and demerits of the breeds of the present day. In order to obtain the practical advantages resulting from the wonderful improvement of live-stock which has been effected during the past century, it is not necessary to trace all the steps which were taken to secure it. To the general principles which should govern the breeder we shall allude at the proper time, but with the exception of illustrating and enforcing these principles we shall deal with the present in preference to the past and show what the different breeds *are* rather than how they were formed, and what they have been in the progress of their development.

THE SHORT HORN.—This breed has many excellent qualities. It is an old and well-established race, and for a hundred years has probably been more popular with the people at large than any other breed. It is a large breed, but matures reasonably early, and, with good feeding and care, proves very profitable. Good pastures in summer and liberal feeding in winter are essential to success in developing the best qualities of this breed. Perhaps the same might be said of every other valuable race of cattle. Still, we think that there are breeds which will be much more productive and profitable when poorly kept than the SHORT HORN. In the splendid blue grass region of KENTUCKY this breed finds everything adapted to its perfect development, and the animals grown here are unsurpassed in excellence. In OHIO and ILLINOIS many fine herds of SHORT HORNS are kept, and there are some fine representatives of this breed in nearly all the WESTERN and MIDDLE States and NEW ENGLAND. While they thrive when well cared for, they will not endure neglect and short feed combined. Either one will soon tell disastrously upon them. We have seen some splendid animals of this breed in MASSACHUSETTS and VERMONT, and on the best farms in NEW ENGLAND.

they do very well. But there are many intelligent farmers who claim that a more hardy breed, which is smaller and which can subsist on less food, is better adapted to the NORTH. We have no doubt that in those sections in which nature has been profuse with her bounties, the SHORT HORN is justly entitled to stand at the head of all races of cattle. But in those localities where the pastures are poor and the hay crop small, some other breed may give better returns.

When properly kept and cared for, the SHORT HORN cattle are excellent for all the purposes which this class of animals is designed to serve. For beef this breed has no superior. This will probably be admitted by all. No better beef, either in point of quality or in perfection of form, can be found than is produced by a well-bred SHORT HORN steer. The animals belonging to this breed can be grown to a large size. A fat ox of this race will weigh several hundred pounds more than one equally fat from a herd of AYRSHIRES. It probably costs considerable more to fatten the SHORT HORN than it does the AYRSHIRE, but the difference in cost is much more than compensated by the increase in value.

Many breeders of this race of cattle have sadly neglected the milking qualities of the stock, and it has by this means come to pass that some of the finest cows in the world for beef and the production of beef cattle are very inferior milkers. Other breeders have not pushed their efforts for success in fattening so far as this, but have kept sight of the milking qualities while also striving to develop the fattening tendencies. Still another class have bred particularly for the development of the milking powers and have succeeded in obtaining very good results. Thus it has come to pass that there are three classes of SHORT HORNS: those which have been bred particularly for beef production, those in which an attempt has been made to combine both the fattening and the milking qualities, and those in which the capacity for the secretion of milk has been fully developed.



FIG. 96.

SHORT-HORN BULL, MAY-FLOWER. Owned by W. H. Winter, Princeton, Ill.

The first class are among the finest animals in the world for beef, the second are excellent for beef and very good for milk, while the third are very fine milkers and quite good for beef. All these classes, however, need a good quality of food and plenty of it. This breed possesses a great advantage over some others in the fact that if the cows prove to be poor milkers they are worth considerable for beef. Also in the fact that their calves are worth more to the butcher than those of the smaller breeds which are kept distinctively as milking stock.

In some sections of the country oxen are used for farm work, and it is important to have a breed of cattle from which good workers can be obtained. For this purpose the thorough-bred *SHORT HORN* is not very desirable. He grows very fast, and, if kept as he should be, will soon become too heavy to work on soft land. He is naturally slow and cannot easily walk fast. In the deep snow with which a *NORTHERN* winter covers the land he is unwieldy, and in the summer he does not endure the heat very well. Still, there are many splendid ox-teams of *SHORT HORN* blood. In many respects the oxen are good, but they are not as good, as far as work is concerned, as those of some other breeds.

THE AYRSHIRE.—The breeders of this race of cattle claim that it is excellent for the double purpose of furnishing milk and beef. But it has been bred almost exclusively for milk, and this is its strong point. The *AYRSHIRE* cattle will thrive on shorter pastures than the *SHORT HORNS*. They are a smaller breed, are pretty hardy, and seem to adapt themselves to the climate and conditions of this country very readily. They are inclined to be irritable, and this fact not only makes it important to handle the cows, and especially heifers, with care and treat them with uniform kindness, but is also an objection to the oxen as workers. The great excellence of this breed lies in its capacity for milk production. Give a representative cow of this breed a good pasture, and feed her well in the winter, and she will yield

a quantity of milk which a cow from no other breed will be likely to surpass, and which cows from only one or two breeds will very nearly approach. Feed her on poor hay in the winter, and keep her in a miserable pasture in the summer, and the quantity of milk which she will give will not be excessive, but it will far exceed that of the cows from the other breeds which attain an equal size.

THE JERSEY.—No breed of cattle has had more opposition in this country than the JERSEY, and no breed has grown more rapidly in popular favor. It is pre-eminently a breed for milk. The animals of this race are too small for beef, and, on account of their diminutive size and consequent want of strength, wholly unfit for working. Oxen are seldom kept, and there is no inducement for any one to experiment with them. In this breed it is the cow, and the cow alone, which possesses special value. Whether she is tender or hardy is a question which receives a great deal of discussion in NEW ENGLAND, where the climate is so severe and many of the pastures so inferior that it is very desirable for the farmers to secure cows which will be at least moderately hardy. Many breeders assert that the JERSEY cow is as hardy as need be, but the popular impression is that she is rather tender. She is quite small in size and may seem more frail than she really is. There is no doubt that if properly cared for—treated as well as the SHORT HORN, AYRSHIRE, or even an extra native should be—the JERSEY will get along without any special inconvenience on account of her want of vigor.

The JERSEY cow is very small, and, therefore, will not require as much hay as a SHORT HORN. But, in order to do her best, she must have all the food she wants and the food must be of good quality. It would be absurd to keep a JERSEY cow on swamp hay and expect her to give as much and as rich milk as the pet cows of the breeders produce. The better the food the better the product—a rule which will apply to other breeds as well as to the one now under consideration.

The quantity of milk given by the ordinary JERSEY is not large. In this respect she is surpassed by the other improved breeds, and even by the better class of natives. But, though small in quantity, the milk of the JERSEY cow is exceedingly rich and more than makes up in the superiority of its quality the deficiency in amount. The great use of the milk of these cows is for the manufacture of "gilt-edged" butter. The best butter sold in the country is made from the milk of JERSEYS, and the price obtained is very much higher than can be secured for a fine quality which is made from other cows. The finest JERSEY butter not only presents a beautiful appearance, but it also possesses a nutty flavor which makes it superior to other kinds.

The value of the JERSEY cow as a butter producer has been widely recognized, and even the SHORT HORN dairymen of GREAT BRITAIN, who consider their favorite breed almost perfection, often keep one or two JERSEYS in their herds for the acknowledged purpose of giving the butter a better flavor and a finer appearance than it would otherwise possess. In this country the superior quality of the JERSEYS for butter production is readily acknowledged. They easily stand at the head of all breeds in this respect, and certainly ought to be found upon a large number of our dairy farms.

THE DEVON.—This is one of the most clearly defined and purely bred races of cattle in the world. It has long held a high place in the estimation of intelligent breeders of live-stock, and it possesses sufficient merit to assure its permanence. Of medium size, beautiful form, and good temper, the cows are well fitted for the dairy and the oxen for the yoke or for beef. The DEVON will thrive on shorter pastures than some of the larger breeds, and seems particularly adapted to the mountainous regions.

For all purposes for which cattle are wanted on the farm they have no superior. They are valuable for beef, as they gain

rapidly and mature at an early age. It has been claimed by competent writers that "more meat can be made from them, with a given amount of food, than from any other breed." The quality of the beef is also superior, and well-fed DEVON steers generally command the highest market price.

For work on the farm the DEVON oxen are the best which can be found. They are hardy, very strong, remarkably active when at work, and also good tempered, quiet and docile. In the sections where oxen are largely used as workers this breed ought to be kept for the purpose of supplying this need. The DEVON oxen are so much quicker in their movements than the native, or even the SHORT HORN, that they will do a great deal more work in a given time. They do this extra work without fretting, and if well fed will perform considerable labor and gain flesh at the same time.

For milk the DEVON cow holds only a medium rank. This is not so much due to the want of capacity for a high rate of milk secretion as it is to the fact that the efforts of breeders have been mainly devoted to an altogether different purpose. The DEVON has been bred for beef and work. As a natural and inevitable result the milking properties have been kept in the background. But the quality of the milk obtained is very good and there are families which, having been bred more carefully for this purpose, are noted for the quantity which they produce. On short feed they will probably do better than cows from larger breeds or from races which are more noted for their milking qualities.

THE HEREFORD is an excellent breed for beef. It has no special excellencies as milking stock, and therefore is not fitted for the dairy districts. As the oxen are very large and heavy they cannot compare favorably with the DEVONS for working purposes. Their strong point, and their chief point of superiority, is in their fattening qualities. They take on flesh rapidly and make a good quality of beef. They need good keeping

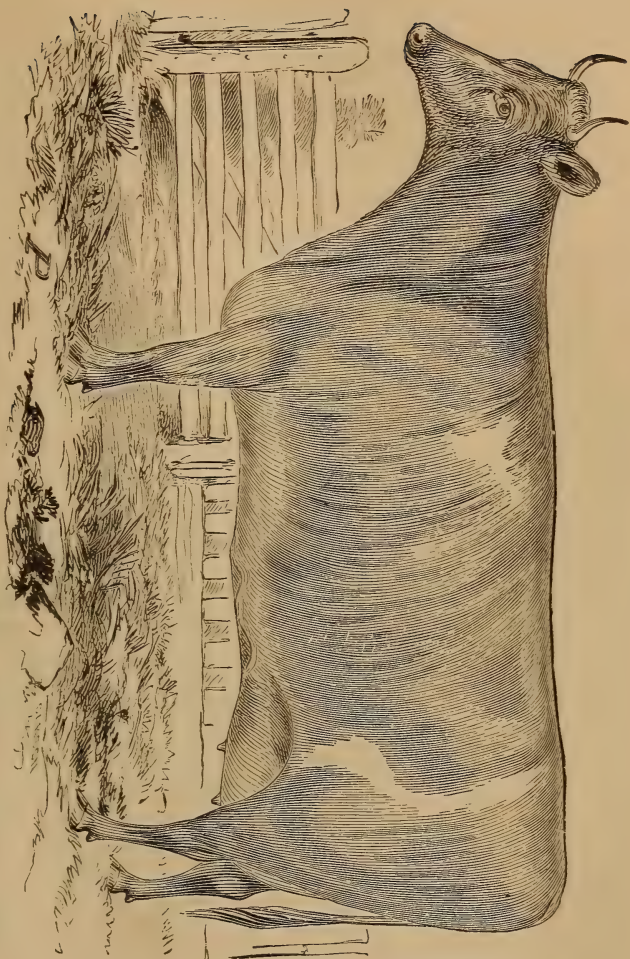


FIG. 97.—AYRSHIRE COW—"DAISY,"
IMPORTED BY T. S. COOPER, OWNED BY THOS. T. TASKER,
PHILADELPHIA, PA.

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and are not well adapted to the short pastures or the mountainous regions of NEW ENGLAND. In OHIO, ILLINOIS, and KENTUCKY they grow into splendid animals. It is claimed by the breeders of HEREFORD stock that this animal is more hardy than the SHORT HORN and superior to all other breeds for crossing with native stock for the production of beef. The grade HEREFORDS of COLORADO sell higher than any other cattle from that section, and it is thought that in the ROCKY MOUNTAIN country on the east and the STATES and TERRITORIES west of this great range the HEREFORD will fully meet the requirements of cattle-owners.

THE DUTCH.—These cattle are very large, and their colors, which are black and white, set off their massive proportions to good advantage. In their own country the cows are great milkers, and many animals have been imported in the hope of securing a breed which would present the same characteristic here. These cattle have been bred particularly for milk production, and the country in which they have lived is one of the very finest for dairy purposes of any in the world. As a natural consequence the change from the mild climate and luxuriant pastures of HOLLAND to the variable climate and still more variable pastures of large sections of our own country does not prove favorable, but exerts a depressing influence. Still, it is claimed by their owners here that the DUTCH cows yield an immense amount of milk from which a large quantity of butter can be made. These cows are also said to be especially adapted to the cheese-producing districts.

For beef the DUTCH cattle are quite good, but not better than several other breeds, while inferior to some. The same may be said concerning working oxen. The animals reach an excessive size, but as they mature rather slowly they are not likely to prove as popular as some other breeds.

THE HOLSTEIN cattle are similar to the DUTCH, and the two names are often used to represent the same cattle. The distinc-

tion between the DUTCH and the HOLSTEIN is that the former name stands for the common breed of cattle in HOLLAND, while the latter represents the breed kept in the NORTHERN part of the country which is called HOLSTEIN. The HOLSTEIN cattle are so nearly like the DUTCH, they need no separate description. Their breeders call them far superior, but this claim is rejected by the owners of the DUTCH.

THE ALDERNEY.—This breed is so similar to the JERSEY as to require no separate notice. Many JERSEY cows are, improperly, called ALDERNEY. In reality there are but very few genuine ALDERNEY cows brought to this country.

THE GUERNSEY.—This breed also resembles the JERSEY, with the exception of being considerably larger. It is an excellent breed for milk, though not as popular as the JERSEY. These three breeds, JERSEY, ALDERNEY, and GUERNSEY, are obtained from the BRITISH CHANNEL ISLANDS, bearing these names, lying off the coast of FRANCE. The JERSEY is the best known, and for use in this country is much more promising than the others.

THE SWISS cows in their native land are very good milkers and prove quite profitable to their owners. There have been only a few importations into this country. The owners of these cattle claim that they have positive merits which entitle them to a fair and extensive trial. But they do not become popular and are not likely to supplant the breeds which are now well established. While there is no doubt that the SWISS are good cattle, it is a question whether it is best to continue the multiplication of breeds to a great extent. It may pay better to take care of the kinds of cattle already secured than it will to seek for others whose merits are likely to be inferior to those of some races which are already acclimated.

The same principle applies to the BRITTANY cattle as well as the SWISS, with this exception, however, in favor of the former. For the BRITTANY there is a place which no other breed exactly



FIG. 98.—IMPORTED HEREFORD BULL, SUCCESS. Three years old.
Owned by T. L. Miller, Beecher, Ill.

fills. Being very small these cattle are neither useful for work nor for beef, but in short pastures, and hilly districts, the cows may be made to supply their owners with milk. They are so very small that it is useless to think of making them pay in good dairy regions. The only animals we have ever seen of this and of the SWISS breed were kept for a while at the MASSACHUSETTS AGRICULTURAL COLLEGE. After a fair trial with other breeds they were both discarded. The milk of the BRITTANY was rich, and its quantity much greater than the diminutive size of the cow would lead a stranger to expect. Still, when compared with other breeds, the BRITTANY was not profitable.

NATIVE CATTLE.—All the breeds which we have described had their origin in EUROPE, and most of them have been in the process of formation and development for at least a hundred years. In our own country, the efforts which have been made for the improvement of cattle have been by means of an infusion of this foreign blood. All “thorough-bred” cattle, so called, must trace to importations on both sides of their families. But there are, in all parts of the country, a great many cattle which belong to no particular breed, and which are usually denominated “natives.” The better class of the common cattle are called grades—a term which indicates that on one side of the family there has been a thorough-bred ancestor. But with the possible exception of TEXAS and vicinity, we have no genuine native cattle in the UNITED STATES.

The original “cattle” of this country were the BUFFALOES, which under a wasteful and wicked system of management have been nearly exterminated. But the so-called native cattle of the older settled States are descended from cattle imported by the colonists and their immediate successors. The men who settled the STATES came from nearly all parts of EUROPE and brought cattle from their own homes. Many cattle were also imported from the WEST INDIES. At that time the principles of breeding were less understood than they are at the present day,

and the colonists in their efforts to subdue the wilderness, clear the forest, and protect themselves from the INDIANS, had little time and but few opportunities to improve their stock. In the course of time it very naturally came to pass that the leading distinctions which the various breeds had possessed were lost, and the cattle which were produced by so much intermixing of different bloods came to bear no resemblance to their progenitors, and to present but little similarity among themselves. Although very far below the "thorough-bred," many of our native cattle have good blood in their veins, and are capable of great and rapid improvement.

The TEXAN cattle have been long in the country, and are nearer alike than the so-called natives of any other section. Their greater resemblance to each other may be accounted for on the supposition that while the cattle of the other sections are descended from several distinct breeds, which were brought from many different countries, the TEXANS had their origin in a single race of SPANISH cattle, many representatives of which were brought into MEXICO (to which TEXAS then belonged) some three hundred and fifty years ago.

The native cattle of the SOUTHWEST are now sent in large numbers to our NORTHERN and WESTERN markets. They are very coarse, and greatly inferior to all other races of cattle known in the country. They ought to be superseded by some of the improved breeds. Perhaps it would be possible to improve them, but it would require a great deal of time to bring up these ungainly animals to a respectable position. Half-way measures might help some, but it would take a great while to secure anything like satisfactory results.

Such are some of the characteristics of the different breeds of cattle which are the best known in this country. From the description given, it is easy to see that no one breed will be profitable in all places, and that no one breed is the best for all purposes. The breed which will pay the KENTUCKY farmer the

best may be one of the very poorest of all for the farmer in MAINE. Again, the breed which will be the most profitable for the farmer who makes a specialty of beef will be likely to prove unprofitable to the one who is engaged in making butter or selling milk. The choice of breeds must be made with reference to the character and condition of the pastures in which the animals are to be kept in summer, and the quality of the food which they can have during the cold weather, together with the particular purpose which they are designed to serve. A large and hearty breed should not be selected for short pastures, and an extra breed for beef should not be chosen for the dairy. It is not well to have many breeds represented in one herd. When this is done, some of the classes must be much better, either intrinsically or by adaptation, than others; the poorer ones will not pay as well as their companions, and thus the average profit from the herd will be reduced. Besides, there is some difficulty in keeping several breeds together, and it occasionally happens that in a dairy the difference in the quality of the milk of different breeds of cows proves a positive disadvantage. This is not always the case, but it does sometimes occur.

The question, "Are thorough-breds required?" is often asked by dairymen, and by farmers who are anxious to obtain as large a percentage of profit from their live-stock as can be secured. It is a question in which every man who keeps cattle of any description is interested, and which he certainly ought to consider. There is a great deal of prejudice in many places against thorough-bred stock, but it is almost wholly founded upon a misapprehension. The idea which some farmers have that the blooded stock is superior only in the possession of a pedigree is erroneous. Thorough-bred stock is valuable in and of itself, while the pedigree is useful only as a certificate of careful breeding. The thorough-bred has inherited many good qualities from his progenitors. Good animals were chosen at first, and for many generations no poor ones have been permitted to

come into the family. The good points are strengthened and intensified in each generation, and in time they become firmly fixed. They are then transmitted with a great deal of certainty. It is true that there are a few exceptions. There are exceptions to every rule. There have been some thorough-bred cows, even in breeds which excel in their milking qualities, which were very poor milkers. These cows never should have been used for breeding purposes. They ought to have been fattened just as soon as possible after the discovery was made that they were not good milkers. Many breeders follow this course.

But some men insist that a thorough-bred is a thorough-bred, and that though an occasional individual may be poor, yet the defective one may transmit the good qualities of its progenitors instead of its own deficiencies. This is not a safe course to pursue, and the fact that it is followed to some extent has brought blooded stock into discredit with many farmers who would have been glad to obtain it if it had been properly bred. In a massive stone tower it is not enough that the great majority of the granite blocks are large and perfect. Every one must be right or the safety of the whole structure is endangered. One poor block may ruin the whole. So with blooded stock. The glory of this stock is that it will *breed true*. If a man has a native cow, he may obtain good calves from her or he may secure poor ones. The calf from a good native cow may inherit the good qualities of the dam, but is fully as likely to possess the evil ones. But in the case of properly managed thorough-breds there is but very little risk. The calf of a good blooded cow is almost sure to be good, and to have the good qualities of the parents so strongly impressed that it can transmit them with a great degree of certainty. There can be no possible doubt that for breeding purposes thorough-breds are greatly superior to either natives or grades.

Admitting that they are better, the farmer is still brought face to face with a great difficulty in obtaining thorough-bred cattle.

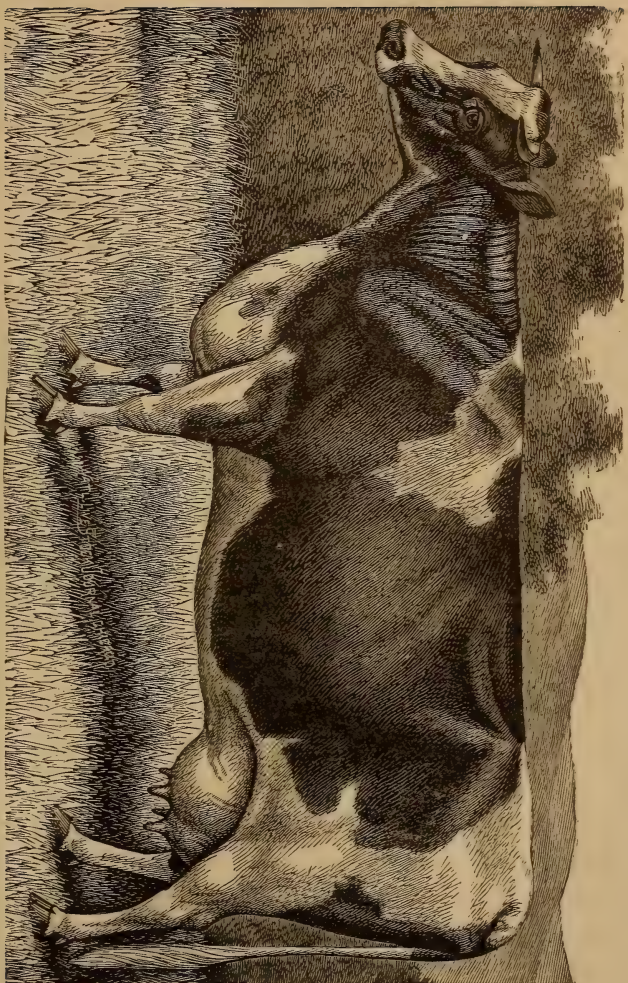


FIG. 99.
HOLSTEIN COW.—Melka. Imported by Geo. E. Brown & Co., Aurora, Ill.



The expense of filling his yard with this kind of stock puts it wholly out of the question. Besides there are not animals enough of this kind in the country to supply one farmer in a hundred if he should attempt to keep them exclusively. The plan of stocking our farm-yards with thorough-bred cattle is wholly impracticable. But a large proportion of the benefits to be secured from this kind of stock are still within reach of the ordinary farmer.

We have shown that the great superiority of thorough-breds lies in the fact that they breed almost absolutely true to the good qualities which they possess. Now let the farmer select from his own herd, or buy of his neighbors, the best native cows, and commence the process of improvement. If he wants to raise beef cattle, he should select cows which have a strong tendency to fatten. If he wants to sell milk, the cows which give the greatest quantity of milk should be taken for this purpose. If he desires nice butter, let him select the cows which now furnish the richest cream. Then let him obtain a thorough-bred bull, of a breed noted for the particular purpose which he has in view (an *AYRSHIRE*, if he wants to sell milk, and a *JERSEY*, if he wants nice butter), and mate him with the cows he has selected. The first cost of a two years old bull will not be very great, and he can, for a few years, breed quite closely without bad results. Then he can exchange with some other farmer who is going through the same course. The blooded bull usually imparts his own characteristics in a great degree to his calves by native cows, and it is to be expected that the stock thus obtained will be much superior to the dams. The bulls should not be kept for breeding, but the heifers, even though they do not look very promising, should be carefully tested. If they prove to be without special merit they should be fattened, but if they are good, as most of them will be, they should be kept until something still better can be secured. Their calves will be likely to show a still greater improvement, and if the process is repeated

with successive generations, the time will come when the stock will be almost pure in blood, and, except for breeding, will be just as good as that which is purely bred. The number of poor animals in a herd will rapidly decrease with each generation until the proportion will be but little greater than it is in those which are strictly pure.

Although it was once thought that "in and in" breeding would prove ruinous to the herds in which it was practiced, it has, in intelligent hands, proved the means of securing the finest animals. All the celebrated breeds have been formed in this way, and by this means the careful farmer may greatly improve his stock. But it should be carried to extremes only by the most skilful breeders. The farmer may safely use the same bull for two, or possibly for three generations, but it will usually be better to exchange with another farmer or breeder than to carry it any farther.

If the farmer keeps but few cows and does not feel able to either buy or keep a bull, he may be able to get some of his neighbors to unite with him in the purchase, and to help pay the expenses of keeping. In this way the cost to the individual may be brought very low, and yet nearly all the benefits of sole ownership may be obtained. In all cases when a bull is bought for the purpose of improving native stock a good one should be obtained. Not merely a good-looking one but one from a good family, and one which is clearly marked with the peculiar points which distinguish the breed to which he belongs. A poor bull should not be taken as a gift. On the other hand it is not necessary to obtain members of the fashionable families. Animals from herds which are just as good for milk or beef, and which will breed with an equal degree of certainty, can be had for moderate prices, and will prove just as good for the purpose of improving the cattle with which they are used. A thoroughly good, but not fancy, bull should be obtained from an honest and intelligent breeder. Then the way will be opened

for a rapid and permanent improvement of the cattle kept on the farm.

Probably no one will question the fact that thorough-bred cows are much better for milk and butter than the average natives, but there may be some who doubt whether it would pay to get blooded stock merely for the purpose of producing beef. If they would read the reports of the sales of beef at any of the principal markets in the country, and trace the difference in the blood of the steers there sold, their doubts would vanish. They would find that grade steers not only average much heavier in weight than natives, but also that they frequently sell considerably higher per pound. The beef cattle which have been sent to ENGLAND have shown the same variation in price. Those which were well bred have sold for from one-half to two-thirds more per pound than those of poorer quality. Thus there is a double gain in using high grade steers for beef. They fatten much more readily than the natives and sell for a higher rate per pound.

In order to obtain really good animals it is necessary to give them care and attention from their earliest hours. Good blood is an immense advantage, but it cannot atone for want of food and care. Many of the native cattle are far inferior to what they would have been if they had been suitably attended to while they were young. It pays to care for stock during all stages of its existence, but care seems a greater necessity in the dependent period of early life than it does after that time of weakness has passed.

Feeding with reference to the perfect development of the animal should commence even before its birth. During pregnancy the cow should be fed with a more liberal hand than at any other period. Not only is the waste of her own system to be sustained, and her usual quantity of milk to be furnished for several months, but the calf must be nourished, and its growth be made from food supplied to the cow. It is not well to feed

the cow so that at the time of parturition she will be very fat, yet it is still worse to keep her on such short rations that she will be very poor. Good food in abundance, but not in excess, should be supplied.

The length of time which she should go dry will depend upon the milking qualities of the cow herself. Some cows dry off three months before calving. These animals are generally unprofitable. Others give quite a quantity of milk until within about two months of the time to calve. There are a few cows which continue to give milk until the very time of calving. It seems to be best for both the cow and her calf, as well as most for the interest of the owner, that there should be a period of from six to eight weeks during which the cow should go dry. Most cows will gradually diminish the quantity of milk which they give and the flow will finally cease of itself. But there are some cows in which the milking qualities are so fully developed that a special effort must be made to induce a cessation of the flow of milk. The best method for accomplishing this result is to draw the milk at irregular intervals. This is very much better than the common practice of taking only part of the milk at a time. When the latter course is followed, the milk which remains becomes thick and putrid and frequently leads to inflammation and other serious evils. The period between the milkings may be gradually lengthened, and should not be at all regular, but, when the milking is done, it should be as thoroughly performed as at any other time. For some weeks after the cow is thought to be dry the udder should be frequently examined, as milk is often secreted in small quantities after the owner supposes the process to have ceased.

If the cow has been properly fed and cared for she will be pretty sure to go through the time of calving without great difficulty. Still, there are some cases of wrong presentation of the foetus and of certain other difficulties. In these cases a veterinarian should be employed. He may be able to save

the life of both cow and calf. No ignorant, brutal help should be accepted. It is not well to allow the cow to calve in the pasture. She should be turned into a box-stall in which there is a large quantity of bedding, or else under a comfortable shed.

Whether the cow should be allowed to eat the "after-birth" is a question upon which intelligent owners are disagreed. Some strongly advocate its removal, while others just as strongly insist that the cow should be allowed to follow her natural instinct. We have often tried each plan and have never known either to be attended by bad results. Immediately after dropping the calf the cow should have a warm bran-mash. This will tend to produce an easy separation of the after-birth. If it proves ineffectual, tie a weight of one or two pounds to the protruding part. If no progress has been made after a lapse of ten hours, a dose of salts, four ounces, and ginger, two ounces, may be given. In case this does not secure the removal of the after-birth within twenty-four hours after calving it must be taken away by force. The right hand (the hand and arm being well smeared with oil, or fresh lard) should be introduced into the womb and the membrane separated with the thumb and fingers from its various connections. A great deal of care must be used in performing this operation, and considerable time may be required. All violent pulling endangers the life of the cow, and many fine animals have been killed by ignorant or brutal operators. For a few days after this operation the cow should be fed on warm mashes and fine hay, have warm water to drink, and be carefully protected from cold and storms.

No cold water should be given to a cow for several days after she has calved, even though she may have got along well. She should have water frequently, in small quantities, but it should be warmed sufficiently to take off the chill. Neglect of this is very likely to cause an attack of milk fever, and by this means many nice cows have been lost.

CARE OF THE CALF.—The calf will usually be able to stand, and to secure the milk which it needs without aid, but, in case of weakness, it should be held to the cow until it gets its food. In any case the calf should be allowed to stay with the cow for three or four days and take as much milk as he wants. The remainder of the milk should be drawn by hand at least twice a day.

If the calf is designed for veal, he may, at the end of the time stated, be tied with a strap around the neck. At morning and night he should have access to the cow. If she does not give all the milk the calf wants he may be taught to eat a little meal. If INDIAN meal is given it should be cooked. Oat meal may be fed either cooked or raw. Some live-stock owners prefer oil meal. Only a small quantity should be given at first, and the increase in amount should be very gradual.

If the calf is to be raised, it should be taken from the cow at the end of the third or fourth day and tied in a stall which is well out of her sight. It should be taught to drink, and, for several weeks, should have new and warm milk. Then, as most farmers consider this food altogether too expensive for permanent use, the new milk may be gradually diminished and the quantity kept good by the addition of milk that has been skimmed. After a while skimmed milk, which should always be warm when fed, with the addition of a little oat meal, may be used to the exclusion of new milk. If the weather is warm the calf should have a nice yard out of doors where it can stay during the daytime, and in which it can learn to eat grass and drink water. At night, and during hard storms, the calf should be tied in a clean stall in the barn. The milk and meal should be continued until the first of winter, and in the case of late calves still longer.

If the weather is cold, so that the calf cannot be kept out of doors without discomfort, it should be tied in a warm stall in the barn, and, in addition to the milk and meal, should be sup-

plied with rowen hay. During the first year or two of its life, the calf should not be yarded with cows and large cattle. It is the best way to keep two or more calves together, and allow them a small yard of their own. In summer, after they are two years old, they can run in the same pasture with the cows, if a shelter is provided to protect them from storms and from extreme heat. Many farmers send their young stock to an "outland" pasture. This is often many miles from home, and the young cattle do not receive the attention which they need. If the season is favorable they may get food enough, but if there is a severe drought the grass will be of poor quality if not insufficient in quantity, and there is danger, in many pastures, of suffering for want of water. It is also the custom to turn into the pasture a "scrub" bull, and by him the heifers are got with calf. From an ordinary specimen of this stock no one has the right to expect a decent calf. There is a direct loss on the first calf, and the heifer is injured for the production of good stock by the service of the scrub.

Not only are small and coarsely made bulls put into these pastures, but sometimes those with still worse defects are employed. We knew one case in which a badly deformed bull was used. It ought to be a principle with the farmer never to allow a poor bull to serve one of his cows or heifers. If he does allow it, he throws away the chance of obtaining a good calf, and allows the cow to be permanently injured.

CASTRATION.—Male calves, which are not desirable to keep for breeders, should be castrated when two or three months old—always before they reach the age of six months. Good weather should be selected for the operation. The directions given by MR. ALLEN in his work on AMERICAN CATTLE are excellent. We quote them, as follows: "Grasp the scrotum in the left hand, and bring the testicles down to the foot of the bag; then, with the other hand, and a sharp, small knife—a sharp-pointed *jack-knife* is as good as any—cut a perpendicular slit in the

back or rear side of each testicle, *close to the bottom*, and long enough for the released testicle to pass through; then cut through the skin, and the inner case enclosing it; push out the testicle, and gently draw the cord attached to it out one or two inches, and cut, or *scrape*, it off, and the work is done. Serve the other in the same way. Then put in a little *salted*, soft greese, and push it upwards towards the belly with the finger. If the weather be hot, a few drops of spirits of turpentine mixed with water may be washed just within and around the outside cut of the scrotum to keep off flies, and the calf may be set at liberty." If the scrotum becomes swollen and badly inflamed, the calf should be caught and the incisions opened sufficiently to allow the matter which has formed to be discharged. Care should be taken to protect calves which have been castrated from storms, and they should have plenty of good food.

Steers, which are designed for work, should be handled and trained at an early age. They should never be allowed to get wild, or to fear in the slightest degree the presence of man. While they are calves they should be accustomed to being led with a halter, and should be tied in the barn at night. If this is done, the "breaking" process will be short and easy. Quiet and submissive oxen will also be secured. But if all handling and training is neglected until the steers are three years old, it will be a very difficult matter to "break" them, and they will be likely to be violent and intractable in all their after lives. A small yoke should be obtained, and the steers brought under it as soon as they are a year old. Some good trainers begin at a still earlier age. If care is used not to scare them, and a rope is put around their horns so that the driver can guide them a little, the steers will soon learn the lesson required. When they are well taught to walk around where the driver wishes, they may be put in front of some large cattle which are attached to a cart and given a few lessons. Then they may be fastened to a very light wagon and driven alone. They should

be taught to back, as it is often a very great advantage to have oxen which will go backwards as well as forwards. The method of teaching is precisely the same as that which has been recommended for horses.

Steers should never be hitched to a heavy load until they have been thoroughly taught to draw and have become large and strong. Most of the cattle that are not good to work have been made inferior by neglect of training, bad training, or by having been overloaded when they were young. For quite a while after the steers have been taught to draw a cart but little weight should be added. When they are well used to this, part of a load may be put in the cart, and this may be gradually increased, as the steers gain strength and skill, until a full load is readily drawn. The training should be so thorough that one man can readily use the oxen for plowing. One of the greatest wastes of labor which we have seen in NEW ENGLAND, where things are usually viewed from an economical stand-point, is the use of a yoke of oxen which required the time and labor of a man to drive. Plowing in this manner—one man driving a single yoke of oxen, and another holding the plow—is a very expensive operation. There is no necessity for using such inefficient cattle. If well taught when they are steers, and decently used afterwards, cattle can be driven by the man who holds the plow. Not only this, but they can be driven as easily and as well as an ordinary horse team. There are many such oxen, and we are sure that many of those which are now awkward and unmanageable would have been good workers, if they had only been properly trained and used.

THE BULL should be well fed and cared for, but should not be forced either to grow or fatten. While it is very bad to keep such a calf half starved, it is also bad to keep him stuffed and crowded with stimulating food. He ought to grow up naturally, and be developed at the time and in the manner which nature indicates. If this plan is followed, he will not look as well as

one of the same degree of merit which has been forced to make an excessive growth, and whose defects are well covered with fat, but at two years of age, and from that time through life, he will be a more vigorous and serviceable animal.

The bull should be used but very little for breeding until he is two years old. Earlier service would prove injurious to him, and his calves would not be as strong and fine as they ought to be. At two years of age he may safely serve from fifty to eighty cows during the season. After that, until he is ten or twelve years old, and his powers begin to fail, he may serve one hundred cows per season. If kept in a stable, he should be led around the yard for a while each day for exercise. It is better to keep him in a stable and small yard, and allow him to go from one to the other at will. He should *not* be turned into the common pasture with the cows. He ought to be well fed, but not kept very fat. During the first year of his age, a copper ring should be put in his nose. A light, strong stick, seven or eight feet long, with two links of chain and a snap at the end, should be used for leading him. A rope tied into the ring is not safe, as the leader has nothing to prevent the bull from rushing upon him.

Sometimes a bull that has always been kind will have a sudden turn of frenzy, and, if he is unprepared for an attack, the keeper will be seriously injured or even killed. Such cases are not very rare. Therefore, no matter how pleasant the bull may be, *never* try to lead him without a stick fastened to a ring, or some good substitute, in his nose. We have seen a "bull-leader" which could be instantly put in position or removed, and which does not require a hole to be made in the cartilage of the nose, or a ring to be inserted. It is very convenient, and if the keeper will remember and use it when the bull is pleasant as well as when he appears to be vicious, it may be an improvement on the common ring.

Some, though not all, bulls which are cross are made so by

violent treatment. At all times, from the first day of his existence, the bull should be treated kindly. Still he must be managed with a *firm* hand. The keeper must not let the bull think that he is afraid. Nevertheless he should be constantly on the watch lest the treacherous animal make an attack when least expected. If a bull becomes decidedly vicious, he should be sent to the butcher. No one will be safe in caring for him, and his calves will be liable to inherit his bad disposition.

If he is a good animal, a sure stock-getter, and is not cross, the bull may be kept until he begins to fail from age. This will usually be at from ten to twelve years. Most farmers, and many breeders, fatten their bulls when four or five years old. But the best age for the bull as a breeder is when he is from five to ten years old. Then he is fully matured, and his powers are well developed. He will get stronger and better calves than one which is very young. In order that he may retain his powers, the bull should never be overworked. The practice of turning a bull and cow into a yard and leaving them together during the day is to be strongly condemned. One perfect service is not only just as good, but is a great deal better than half a dozen. When regularly serving many cows the food of the bull should be increased, and he should be well fed at all times.

WINTER MANAGEMENT.—In a large part of the country it is necessary to give special care to cattle during the cold season. And we think that in that belt of country lying between the cold region on the NORTH, and the warm one on the SOUTH, where there is but little snow, and cattle can be kept out-of-doors nearly all of the time, it would pay well to give more attention to the cattle during the winter months. Although cattle can live outside of the barns (and the barns even are wanting in many places), yet they would thrive a great deal better, and give much larger returns, if they were protected from the storms, and could be properly fed when the grass in the pastures fails. At the extreme SOUTH the farmer can furnish

excellent pasturage during the winter. The kinds of grass suited for this climate and purpose have already been indicated. The expense of supplying this pasturage is very small when compared with that of wintering cattle at the NORTH, and it should be cheerfully borne.

THE STABLE.—It is a matter of great importance from an economical as well as a humanitarian point of view, that the stables for cattle should be light and warm, and that they should be kept clean. We have already shown that animals which have warm stables are much more productive, with the same amount of food, than those which are placed in cold quarters. The advantage of a light stable over a dark one is evident. Cleanliness is necessary in order to make the cattle healthy and keep them in comfort. The floors should be strong and frequently examined. When cattle break through a weak floor, the owner usually has to sustain quite a loss. We like a double floor under the cattle. Plank the floor in the usual way, and then lay short planks (four and a half or five feet long) the other way. These will be just long enough for the cattle to stand on, the manure will fall behind the short planks upon the long ones, and this arrangement will tend to keep the cattle clean. The floor overhead should be high enough so that a tall man need not stoop in the stable even when he has on a tall hat.

The mangers should be well made, so that there will be no waste of the meal fed in them. Between their tops and the floor above a strong, smooth stick should be placed in order to keep the cattle from climbing into them. The fastenings should be strong and safe, but also as comfortable for the cattle as possible. Bows around the neck do well for young cattle, while stanchions, or chains around the neck, are preferable for larger animals. We like these methods better than tying with a rope around the horns.

Plenty of bedding should be used on the floors. If the floor

descends a little from the mangers towards the back of the stable it will prove a help in keeping the cattle clean. In all respects while they are in the stables the cattle should be made just as comfortable as possible.

An easy way of getting into and out of the stables should always be provided. There are many cases in which this is wholly neglected, and the cows have to climb steep steps every time they go into the stable. In some cases they are obliged to wade through mud and manure from one to two feet in depth, and then take a long step to get to the stable floor. We have seen cows hesitate long before they would take a step which required so much exertion. This method of getting into the stable is very injurious to all animals. It is especially dangerous for cows which are with calf, and is quite likely to cause abortion with all of its attendant evils. There should be good steps whenever the surface of the yard—and by surface we mean something which will give a good foundation—is more than ten inches lower than the stable floor. It ought to be just as easy for the cattle to go into the stable as it is to walk on the floor after they are in there. The entrance to many stables, in mud time, and when there is ice on the ground and steps, is positively dangerous, and many animals which receive no more serious injury are made lame by trying to pass from the yard to the stable.

Although the NORTHERN winters are very long, it pays well to commence feeding cattle quite early in the season. If the animals are kept out in the fields until snow comes, there will be quite a time during which they are very poorly fed. The grass becomes spoiled by the hard frosts, and long before the quantity of food begins to fail its quality is seriously impaired. Some farmers seek to mitigate the evil by throwing corn-stalks, or coarse hay, into the fields or the yards. This is well as far as it goes, but it is very far from removing the difficulty. It is much better to put the cattle in the barn and feed them once a

day when the grass begins to fail. As it grows poorer, feed them twice a day, and when the frost has killed it, feed the cattle entirely in the barn. This course requires more hay than the one commonly pursued, but it keeps the cattle in so much better condition that it proves more profitable. Cows which are kept short for a few weeks decrease the quantity of milk which they secrete, and it is difficult to bring them back to the original yield. Young cattle which come to the barn thin in flesh are likely to go out in the spring in poor condition. Here as elsewhere a good start is a great help to a successful ending.

The quantity of food given to domestic animals must depend upon their age, condition, and several other considerations. Some animals will need more in proportion to their size than others. The quality of the food will also greatly modify the quantity which is to be given. But all neat cattle should have food enough. None should be kept hungry. This, because it is both wrong and unprofitable to keep animals without giving them sufficient food. It is much better, in every sense of the term, to keep a smaller number of creatures and give them all they want to eat, than it is to keep a large herd on short rations.

Cattle should be fed several times a day, and, while they should have all they will eat, care must be taken not to give too much at a time. If the mangers are filled too full the cattle will eat what they want at that time and will breathe upon and work over the remainder in such a manner as to render it unfit to eat. In this way careless feeding causes quite a waste of fodder. The feeding should be done at regular hours. If cattle get in the habit of eating at certain times of the day they will be ready to eat when those times come, but, if they are fed irregularly, they will not know when to expect food and will not gain as much from its use as they would from the same amount if it was given at stated times. We usually feed cattle twice in the morn-

ing and twice at night in the barn, and once a day in the yard. The latter feeding is with corn-stalks, which are given when the cattle are turned out in the morning. When the weather is bad we feed more hay in the barn and do not put out the stalks. Many farmers feed their cattle in the evening. We believe it is an excellent plan to go to the barn just before bedtime and see that everything is right, but we are not sure that it is well to feed the cattle at this time. The animals will be lying down quietly for their night's rest and it hardly seems best to disturb them. The owner can see that they are all right without starting them up. If he does not feed them they will, certainly after they get used to his coming, remain wholly undisturbed. We believe it is better to leave them quiet than it is to get them up and feed them.

The quality of food which animals should receive will depend upon many and varying circumstances. When an ox is at work he should have a liberal allowance of meal in addition to a sufficient quantity of hay. If he is to be fattened he should have more meal and less hay than he does while at work. If he is kept idle he should have plenty of hay and a few roots daily. Cows giving milk need a better quality of food than those which have no such drain upon their productive powers. Young cattle need a good quality of hay and a few roots. A little oatmeal may also be given with good results.

The idea that anything which will distend the stomach is good enough for young cattle is wholly erroneous, and has involved the large class of farmers who have held it in a heavy loss. If there is ever a time when good feeding pays, it is when the animal is growing. At this time the ordinary wastes of the system must be met, and the whole body ought to be rapidly increased in size. The meat and bones which should be formed must be made from the food if they are made at all. If that is of poor quality the animal can gain but little, if any, because nearly all the food is needed to supply the waste. We do not

think it well to force animals at this stage of their growth. The use of large quantities of meal for their food is not wise. But good food and plenty of it is necessary to keep young cattle growing, as well as to keep them in good health and condition.

Pure water ought to be furnished in abundance and at a place where all the cattle can easily have access to it. We have already treated of the importance of a full supply of water on the farm, but a few words upon this subject with special reference to the live-stock interest will not be out of place. In every yard in which cattle are kept there should be a tub, or trough, for holding the drinking water of the stock. This tub should always be kept clean and well filled. It should be placed in a sheltered position, and so arranged that the stronger cattle cannot keep the weaker ones from the water. In some yards both of these points are disregarded. The tub is placed where the wind sweeps with the greatest power, and where the strongest animal can, and often does, stand guard and keep the others away. In this manner the weaker ones suffer from thirst, and, after they have had access to the tub, they feel still worse on account of having drank to excess. Where the tub is located so that one or two of the animals keep the others away it will pay to move it to a place in which there will be a fairer chance for all. If this cannot be done, the animals which make the trouble should be kept in the yard only long enough to drink. As soon as they have drank in the morning they should be put in the stable and kept there until the others are put in for the night. Then they may be allowed to drink again. This will prove somewhat injurious to the ones which are kept shut up, but it is better that they should suffer a little than that they should compel all the rest of the herd to suffer a great deal worse.

At all times cattle should have a plentiful supply of salt. Some writers assert that this is unnecessary, but the best physiologists consider it indispensable to the health and comfort of

animals. It is well known that, in their wild state, animals make long journeys for the sole purpose of obtaining salt, and that under domestication they do not lose the craving for this inexpensive article. From many trials which we have made, as well as from reports of other trials, we are fully convinced that salt is not merely a luxury to cattle, but is absolutely necessary to their thrift and comfort. The fact that when used in excess it gives bad results is not proof that it is injurious. Too much green clover induces an attack of hoven and may kill the strongest animal. It has destroyed a great many very fine cattle. But no one claims that green clover must not be fed to cattle. All sensible people know that if it is not used in excessive quantities it is highly beneficial. The same principle exactly applies to the use of salt.

If cattle have not had a supply for a long time they should be gradually accustomed to its use. A small quantity should be given each day until they exhibit no special desire for it. Then put a few quarts in a box under a shed to which they can have access daily and they will eat it as they feel the need of its peculiar properties. In this box a supply of salt should be kept constantly. The cattle will enjoy it and it will do them good.

LICE.—These little parasites cause an immense amount of suffering to the animals upon whom they prey, and a heavy loss to the owners of the cattle which are infested with them. Some farmers estimate the actual damage caused to the owner of the cattle by these pests to be not less than five dollars per year for each animal that is covered with them. This we do not consider an excessive estimate. The cow that is obliged to support an army of lice must give less milk and keep in poorer order than she would if free from her tormentors. With a calf the case is still worse, as he has less strength with which to combat the evil.

It has often been asserted that lice were caused by neglect

and poor keeping of the animals on which they appear. While they are more frequently found in neglected herds than in those which are well cared for, and upon animals which are weak and thin in flesh than upon those which are strong and fat, it is still true that they frequently make their appearance upon thrifty animals and in well-kept herds. These pests are readily transferred from one animal to another, and are often introduced into a fine herd by one or more affected animals which the owner has purchased.

As there is a constant liability that cattle will be troubled with lice, they should be frequently examined. Calves and young cattle need still more careful oversight than cows or oxen.

The remedies which have been employed are various, and some of them, while very effective, have proved more dangerous to the cattle than the lice which they destroyed. Many cattle have been killed, and many others injured, by lapping off the poisonous ointments which have been applied to themselves or to some animal in the same herd. The use of these remedies is dangerous. If they are so applied that cattle cannot lap them off from themselves, some other cattle may do it for them and be poisoned. Even if it remains with the animal to which it was applied, it may be absorbed and cause serious injury. There is no necessity for using such preparations, as safer remedies will be equally effectual.

A mixture of SCOTCH snuff and lard rubbed along the back, on top of the head, around the flanks, and between the hind legs, will answer the purpose without injuring the animal. Tobacco smoke is also effectual, but requires the use of a fumigator to render it pleasant or safe. Even with this instrument the work should be done in the open air, in order to prevent sickening the operator, and also to avoid all danger of firing the buildings. When this method is pursued, the animal must be blanketed for a while after the operation, and the process must be repeated in

a week or ten days, in order to destroy the lice which hatch out after the first one is performed. In mild weather, a wash composed of one part carbolic acid and three parts of water proves both harmless to the animal and effectual for killing lice. It should be freely rubbed along the back, between the horns, and around the tail.

DISEASES.—Cattle are subject to various diseases, but nearly all of them are caused by some error in feeding or management. The animals which are kept poor and half-starved, and those which are highly pampered, are much more subject to sickness of various kinds than those which are well fed and cared for, but are not too rapidly pushed. Several of these diseases are to be successfully treated only by an educated veterinarian or physician. Of these we shall make no mention, except to say that they can almost universally be prevented, and that the great hope of the farmer is in the use of *preventive measures*. Curing severe disease in animals is very doubtful, and the attempt to cure will be very much more expensive than the measures which would have prevented an attack. A few common diseases and accidents should be briefly mentioned in this connection.

ABORTION.—In some sections this disease is very prevalent, and causes an immense loss to farmers and dairymen every year. In this disease, the cow calves before her full time. The calf is lost, and the sickness of the cow renders her nearly useless for several months. In many cases, the cows die at once. As a rule, when a cow loses her calf she will never be a safe breeder afterwards, but will be very likely to have the same trouble with every calf. The disease is not always confined to the cow first attacked, but frequently spreads through the whole herd. It is not contagious, but is almost as likely to spread as any disease with which cows are affected. Consequently, upon its appearance the greatest care should be used to prevent its increase. The affected cow should be secluded

from all the others as soon as there is evidence that she is about losing her calf. The calf itself, and the after-birth, should be deeply buried, and the cows should not be allowed to get sight of them at any time. In the stable in which the sick cow is confined disinfectants should be freely used. This is very important, as it is largely by reason of the foul smell and the consequent excitement of the cows that the disease is spread. There are cases, however, in which the disease spreads because it is due to some general cause to which all the herd are exposed. In such instances, while care should be taken of the individual cows, the cause of the difficulty must be removed before the trouble will cease.

After a cow has lost her calf, she should be fed well and carefully protected from extremes of temperature. She ought not to be allowed to have a calf for a long time, and if not an extra cow had better be fattened at once. When a cow once gets into the habit of losing her calf, she will not be profitable in herself and her presence will endanger the whole herd.

The principal causes of abortion are injuries or frights—often caused by the brutal men or boys who milk and drive the cows, the use of impure water from stagnant ponds, the presence in the pastures, or near the yards, of putrefying animal substances, and the use of hay which is mouldy or which contains poisonous weeds. Sometimes one of these things, or something similar, and sometimes two or more of them combined, bring on an attack. The owners of cows should be careful to avoid all exciting causes, and do all that they can to prevent the introduction of this disease.

CHOKING.—This is an accident to which cattle are liable and which often causes death in a short time. It is usually caused by an attempt on the part of the animal to eat roots, fruit, or vegetables, too fast. When apples are plenty in the pasture the strong animals frequently drive the weak ones from under the trees. As they are leaving they seize one or more apples and

run. In their haste they attempt to swallow these apples without chewing and get choked in their efforts. When roots are fed to cattle in the yards, or without being cut, there is the same danger. All such things should be fed in the mangers, when the cattle are tied in the stables, and should be cut before being given.

When an animal is choked the very best way with which we are acquainted is to turn down a pint of sweet oil. The old fashioned "whale oil," or even lard oil, effects the purpose just as well, but is not very palatable to the animals. This treatment will prove effectual in nearly all cases and is the safest, as well as best, of the common remedies. Those stock-owners who relieve a choked animal by holding up its head and pushing the obstruction down the throat with a broom-handle ought to be choked themselves and "relieved" in the same way. With a good probang the careful operator can successfully accomplish the desired result. If the oil fails and no probang is at hand a very smooth, flexible stick may be used. But to use a straight and large stick is barbarous. Some farmers fire a gun under the animal and say that the fright will cause a sudden spring and the removal of the offending substance. Others tie up one fore-foot and make the creature hop around on three feet. There are various other methods, but the ones described we think will answer every purpose. Here the old proverb about prevention being better than cure has a very direct application. Most cases of choking might have been prevented and the suffering of the animals and the trouble and loss of their owners all been saved.

GARGET.—This is a disease to which cows are subject and which, as far as milking purposes are concerned, spoils a great many good animals every year. In moderate cases it is a local inflammation affecting one or more quarters of the udder. In severe cases the whole system becomes involved. It is caused in various ways. Neglect when a cow is drying off is very likely to produce it. Neglect just before, and for a few days after, calving is still more certain to induce an attack. When

the udder is very much distended, and is hot and feverish, the cow should be milked even though she has not dropped her calf. The udder should be washed, often and thoroughly, with warm water in which a small quantity of INDIAN meal has been stirred. Rubbing is very efficacious. If there are hard bunches in the udder, and the rubbing and the use of the water and the meal do not reduce them, a liniment composed of equal parts of tincture of iodine and ammonia may be used in connection with them. This may be well rubbed in two or three times a day. Only a little should be used at a time, as a large quantity would cause a great deal of soreness. This is an excellent remedy and is also valuable for sprains and rheumatism. If the colorless tincture of iodine is used, the mixture is excellent for rheumatism and neuralgia in human subjects. We know of no other external application which, in all respects, is its equal for these purposes. In addition to the treatment already indicated the calf should be allowed to run with the cow. Draw part of the milk so as to keep the calf quite hungry and thus induce him to suck and "bunt" as much as possible. This is rather hard treatment of the calf, but it need be practiced only a few days and will do the cow an immense amount of good.

If the inflammation becomes general, a high fever sets in and shivering fits come on, give five or six ounces of gin, or whiskey, in three or four quarts of warm water and cover the whole body with a quilt wrung out of hot water. Over this cover some dry blankets, which should be tied so as to keep in place, and give injections of warm water. This ought to induce a profuse perspiration. After the cow has sweat for half an hour the blanket should be removed, the skin rubbed dry, and the animal then covered with a dry blanket. In order to relieve the local inflammation a rubber sack, made for the purpose, which will fit the udder, should be filled with moderately warm water and fastened with a strap over the back of the cow so that the udder can be kept constantly wet. When the water becomes

very warm it should be changed. Instead of the water some writers recommend the use of a poultice, with holes for the teats, fastened in the same way. Upon the poultice a little belladonna should be sprinkled in order to relieve the pain. With this treatment injections of warm water must be used. Sometimes matter forms in the swollen places. This should not be left to be absorbed into the system and injure, perhaps destroy, the cow. The sores should be opened with a sharp knife. This will give relief to the cow and may save her life.

We think that after an attack of this disease, the cow is ever after predisposed to it whenever she calves. Some old cows which have had it lightly several times are almost sure to be attacked at every time they calve, and they are likely to grow worse each time. It is not best to keep a cow that is subject to this disease, and a great deal of care should be taken of heifers when they are about to calve in order to prevent an attack. The idea that a cow will give as much milk from three teats as she does from four is wholly erroneous, and the men who are keeping cows which have lost one-quarter of their udders from attacks of garget, are suffering a constant loss. The nearer perfect a cow is the better, and no owner should allow his cows to suffer from garget when he can prevent it. Even a slight attack involves a direct loss, and a severe one is quite likely to destroy the usefulness of the cow for milking purposes.

HOVEN.—This disease is caused by eating too large a quantity of green food, especially of clover, at a time. The stomach is overloaded, indigestion results, rumination is prevented, and the food rapidly decomposes. By this change a large quantity of gas is generated, and in a severe case, if relief is not quickly obtained, the animal will die in a short time. With this disease medicines are useless, unless given in the very first stages. If attended to at once, the administration of four drachms of chloride of lime in a little water may give relief. Or two ounces of ammonia in a quart of soft water given every fifteen minutes

may be tried. Injections of warm water are also in order, and cloths wrung out in hot water and applied to the skin may aid in giving relief. But in case there is no change for the better in a short time, an opening must be made into the stomach, and the gas allowed to escape. Veterinarians use an instrument called a trocar, which consists of a sharp-pointed stilet, and a sheath. This is the best thing to use, but if one cannot be obtained soon (for there is not much time to lose in a severe case of this disease), a sharp-pointed knife will answer the purpose. The opening must be made on the *left side*. MR. WILLARD gives the position as follows: "The place of puncture is in the flank, about three inches below the spinal column, and mid-way between the last rib and the hip." At this point a small opening should be made. Into this opening a quill should be placed, and through this the dangerous gas will soon escape. After the gas has been removed, the edges of the wound in the skin ought to be fastened together with a stitch of strong silk.

The prevention of this disease is easy and simple. It consists in never giving animals an opportunity to gorge themselves with succulent food. They should never have a sudden change of food, but should be gradually brought from hay to grass. When turned into the "fall feed" (a bad practice, as has been indicated, but still a very common one) they should be allowed to stay only a short time. After feeding for a while they should either be turned into the pasture or else shut up in a yard. By allowing them in the rank grass only an hour in the morning and the same length of time at night, for the first two or three days, and gradually extending the time as they become accustomed to the fresh food, the danger of an attack of hoven may be entirely avoided. It is much better for the cattle, aside from considerations respecting this particular disease, that all changes in the quality of the food given to them should be gradual, and particularly that the changes from dry fodder to green grass, and from short pastures to luxuriant meadows, should be slowly

effected. Neglect of this precaution has caused the loss of a multitude of valuable animals, and the serious injury of many more.

HORN AIL.—This is an imaginary disease about which we used to hear a great deal, and which is still the “standby” of the ignorant cattle “doctor” when he is called to a case which he does not at all understand. This name has done service among these “doctors” for a great while. It has answered for all complicated forms of disease, as well as for some simple maladies, and for the results of neglect and poor keeping. That cattle which have been doctored for “horn ail” have been sick we do not question, but the idea that the horns were the seat of disease is wholly without foundation. The fact that the horns are either cold or hot when an animal is sick, is not proof that the disease is of a local nature. When a man has a high fever his feet will be hot, but the doctor who should say that the feet were diseased, and that in order to effect a cure they must receive special attention, and that all remedies which are given should be selected with reference to their action upon the feet, would be justly considered a quack or a fool. The whole system is diseased, and if remedies are to do any good they must affect the whole body. All merely local efforts to control the disease will be of no benefit, and may make the matter worse. Now when a horned creature is sick, and the horns appear to be of an unnatural temperature, it will be worse than useless to bore holes in them, and stuff in the remedies which are often recommended. Let the horns alone and doctor the animal for fever. If the nose is dry, the legs cold, the breathing short, and the bowels constipated, the horns will be pretty sure to be hot. The use of wet blankets and warm water injections as described for garget will usually give relief, if *tried soon enough*. If the bowels do not move freely, a dose of salts (four to six ounces) with a little molasses may be given. If this does not relieve the patient, send for a competent

veterinarian. There are plenty of other things which the farmer *can* do, but he had better not experiment farther.

In typhoid fever there is usually a diarrhœa and great soreness of the bowels. These cases should be treated by a veterinarian. But if the farmer wants to experiment he can try the water treatment above recommended, and give one-fourth ounce each of Cayenne pepper and ginger in a little oat meal gruel.

MILK FEVER.—This disease carries off many fine cows every year. Many others are seriously injured. We have never known a cow to do well for a year after an attack, and in many cases the animal is spoiled for a milker. As a rule this disease can be easily prevented. A little care at the right time will be very sure to keep it off. If it appears it should be treated at once. Violent cases must be helped very soon or not at all. Mild cases, if neglected, often become unmanageable in two or three days.

The causes of this disease are various. Cows which are very fleshy, or which have been kept high for a few weeks before calving, are more likely to be attacked than those which are thin in flesh and which have not recently been fed with meal or allowed to run in luxuriant pastures. A cow that is suffering from costiveness is also liable to have an attack. But we think that nine cases out of ten which occur in farm-yards are the result of undue exposure. As a rule farmers do not realize the great disturbance to the system of the cow caused by calving, and have no idea that for a few days afterwards she is in a condition which makes her peculiarly susceptible to attacks of disease. Our own knowledge upon this subject was gained at considerable expense, and we came very near losing a valuable cow by carelessness when we thought all danger was passed.

Many farmers allow their cows to calve in the barn-yard in which there is an abundance of water. In the winter this water is ice-cold. The cow is always feverish at this time, and, of

course, quite thirsty. There is nothing to keep her from drinking all the water she wants. She does drink, and thereby renders herself very liable to a violent attack of milk fever. Many cows are turned into wet yards. When the weather is cold this is a great exposure. Even in warm weather it involves considerable risk. Sometimes the cow is cared for a day or two and is then turned into the yard, in all sorts of weather, to fare the same as the rest of the herd. Exposure to a storm at such a time may prove fatal. It is true that many cows treated in this way escape the fever, and that many have it lightly. But a great many die very soon, and those which recover are injured for one season certainly and perhaps for life. The disease is dangerous and should be prevented whenever prevention is possible.

PROF. LAW gives the symptoms of this disease as follows: "Dulness, languor, uneasy movements of the hind limbs, a full, bounding pulse, red eyes, hot head and horns; soon the cow becomes weak on its limbs, unable to rise, lays the head back on the flank or dashes it on the ground, breaking the horns if the surface is hard, and struggles convulsively with its limbs." These are the indication of the disease in its first stage. There is another form in which "the heat of the head, delirium and violence may be almost entirely wanting, the prominent symptoms being the fever, accelerated pulse and breathing, elevated temperature, loss of power over the limbs, paralysis of sensation, inappetence, torpor of bowels and bladder. Both forms of this disease are exceeding fatal, almost all attacked within two days after calving perishing, and a large proportion of those taken ill during the first week."

The treatment of this disease is to be commenced as soon as possible. When the very first symptoms appear, if violent, send *at once* for a good veterinarian. If the attack is mild, give the cow eight ounces of salts with half an ounce of Cayenne pepper, give warm water injections, and use wet blankets. If no veterinarian or physician can be had, and it is absolutely necessary for the farmer to treat a bad case, and he has none of the

HOMŒOPATHIC remedies put up ready for use, he may try the following course recommended for such cases by PROF. LAW: "If the animal is seen before it goes down, bleed four or six quarts from the jugular, but never after the pulse has lost its fulness and hardness; apply ice-cold water, bags of ice or a solution of an ounce each of nitre and sal-ammonia in a quart of water to the head round the base of the horns, give a powerful purgative (two pounds Epsom salts, one-half ounce carbonate of ammonia, one-half drachm nux vomica); apply friction to the limbs, draw the milk off at frequent intervals, and repeat the ammonia and nux vomica every four hours. The nux vomica may be replaced by strychnia, one grain with two or three drops of vinegar in a teaspoonful of water and injected under the skin twice with four hours interval, or ergot of rye may be used instead. The fever may often be materially reduced by enveloping the whole body in a sheet wrung out of cold water, and covering up with one or several dry ones according to the season. In the second or torpid form of the disorder there is often no call for cold applications to the head, while purgatives and nux vomica are especially demanded."

In leaving this subject we cannot do better than to again urge the importance of preventive measures for keeping off disease, and of good care for keeping domestic animals thrifty and making them profitable. The farmer who is careless with his animals thereby takes away all opportunity for making them profitable, and runs the risk of frequent and heavy losses by means of disease. Cattle that are strong and vigorous can resist depressing influences which would completely prostrate those which are poor and weak. Young cattle should be fed in such a manner as to keep them constantly growing, and those which are mature should be kept well and strong. There is no branch of farm business in which care and skill are better invested than in the live-stock department. Neither is there one in which neglect and ignorance are more severely punished.



FIG. 100.—JERSEY CATTLE.—ONE TON 2,000, MARPETRO 3,352, AND BOMA 4,834.
Property of Churchman & Jackson, "Peach Grove Farm," Indianapolis, Ind.

THE DAIRY.

DURING the past twenty years the dairy business has been rapidly increasing in extent. Year by year its proportions have been enlarged until it has become an interest of great national importance. Not only is it a business in which the country has an interest, but it is also one in which the individual farmer holds a share. Almost every farmer, even the one who finds "five acres too much" land for him to cultivate, keeps a cow, and herds of considerable size are very common in all sections of the country except the extreme SOUTH. This is a line of business which can be managed profitably on either a large or a small scale. The man who keeps only one cow can make her pay him well for all the care and cost of her keeping, while the one who has twenty cows can secure a large profit from the sale of dairy products. The business can be gradually enlarged or contracted without the great expense or the heavy loss which usually follows such changes in other lines of work. It is a very safe business, and one in which care and skill will be likely to find a prompt and liberal reward. The products of the dairy are standard articles throughout the civilized world and will always be in demand.

Just now prices are depressed, and many farmers and dairymen are feeling somewhat discouraged, and are inclined to give up, in a measure at least, this branch of their business. NEW ENGLAND dairymen, too, have found strong and unexpected competition in an unlooked-for quarter. The WEST, which used to send a great deal of "grease" to the NEW YORK market, has been rapidly improving the quality of its dairy products, and the EAST now finds that its competitor is making some of the finest butter in the world. At the SOUTH, too, there is an increased interest in the business of keeping cows, nice butter is being made, and more dairy products will come from this section than ever before. These facts tend to discourage many farmers who

make butter and cheese for the market. But they should not be alarmed. The fact that prices fluctuate is evident, but fluctuation is to be expected in this, and every other, line of business. When business is dull, and almost all kinds of goods sell for low prices, it is perfectly natural that dairy products shall, to some extent, share in the prevailing depression.

But there is no danger that these standard articles of food will long be sold for prices which will not pay the producer. We have a large foreign trade already, and it can be made a great deal larger. And, if a good article of butter can be made for a low price, the rate of home consumption will be doubled in a very few years, while the demand for an extra quality will probably increase in a still larger proportion. This demand, too, will be for butter at prices for which it can be profitably made and sold. By following the best methods the farmer can manufacture good butter and sell it for a lower price than he has thought possible. That fair grades of butter will find a ready market in very much larger quantities than they have yet been offered may be considered as beyond all question. The farmer or dairyman who can make good butter for a moderate price can sell, in his nearest city market, for cash. From statistics published in the *CINCINNATI COMMERCIAL* it appears that there are a multitude of people in that city who do not use butter at all because, and only because, they cannot afford it. The writer of the article in which the figures were given went so far as to say that "very nearly, then, one in three of our citizens never tastes butter, an article of food generally regarded as a necessity of life, and one from which few, if any, would abstain except on account of pecuniary considerations." This will be generally considered an extreme view, but, after making all due allowances, the fact will remain that even in such a prosperous city as *CINCINNATI* there are many thousands of people who cannot afford butter at present prices. In other cities the same state of things exists. Make the butter a little cheaper and

many who do not buy now will be able to purchase. Or, make the butter a little better and sell it for the same price, and many who do not now buy because they cannot pay the prices for fancy butter and will do without rather than eat the poor grades will become buyers. There is no doubt that good butter can be sold, both in this country and abroad, in immense quantities. And we are confident that it can be sold at paying prices. The methods to be pursued in order to secure this very desirable result will be duly considered. Butter has been specified, but the same principles apply to the production and sale of the other dairy products, milk and cheese. Furnish pure milk at a moderate price and an immense quantity can be sold in all our city markets, and a largely increased demand will come from villages and large towns. Supply a good quality of cheese at a reasonably low price, and the great foreign demand, the calls of our cities, and wants of village and town consumers will require a largely increased rate of production.

Let no one say that prices are already so low that there is no profit in any of these lines of business. The improved methods of the present day make it possible for farmers to furnish these articles much cheaper than they could in the old times. Yet, even then, when prices were far below the present average and the cost of production much in excess of that of these days, farmers obtained a fair profit from this department of their work. Besides, low prices are not greatly to be feared. Political economists assert, and the history of the civilized world proves them correct, that moderately low prices mark the periods of steady and uniform prosperity, while inflated prices mean a temporary good to be quickly followed by a long period of depression.

In order to furnish the products of the dairy at prices which will insure their ready sale and still leave a margin for profit it will be necessary to commence at the very beginning. Here is where the great majority of farmers, and a large number of dairymen, have failed. They have been building on a poor

foundation, and all their efforts in the line of improvement have been directed to the superstructure. Consequently, these efforts have not been as successful as they should have been, and many parties have become discouraged. But here, as elsewhere, and everywhere, it is unprofitable to build upon an unstable foundation. A man must reap according to his sowing. He can have wheat or weeds just as he chooses. But if he wants wheat he must sow the seed and take care of the plants. If he does not furnish any wheat for sowing he cannot reasonably expect any wheat at harvest time. If he sows only half enough wheat, and allows half the land to grow up to weeds, he cannot look for a large and valuable crop of grain.

Now apply the same principle to the dairy business and we have a "good and sufficient" reason why there is so much complaint that dairying is unprofitable. The farmers and dairymen are keeping *too many poor cows*. Take an average farmer for illustration. If he has ten cows he will probably say that there are two or three in the herd which are very much better than any of the others. Also that there are two or three which fall considerably below the average, and that the medium ones are pretty fair cows. Now look at this statement in a business point of view. Out of a herd of ten cows there are two or three which pay a large profit, two or three involve an actual loss, and from four to six which pay their way but are not very profitable. The gain on the two or three extra ones is used to pay the loss on the two or three poor ones, and the middle class yield only a very small profit. It is not surprising that the dairy business does not yield very large returns when such a foundation is laid. Ten cows like the best ones would yield a large profit. It is from the best ones in a herd that the profits, if any are received, invariably come. But too often these profits must be used to make up the deficiency of the poorer cows. In such herds, and there are multitudes of them, the first thing to be done to put the dairy business on a good basis is to obtain some

better cows to take the places now occupied by the poor and medium ones.

Here the farmer will say that it is very difficult to buy good cows, and that if he could find plenty of them he could not afford to pay the prices at which they are held. It is true that first-class cows are not very plenty, but they are not so extremely scarce as many people imagine. In regard to the ability of the farmer to buy a good cow rather than a poor one there seems to be a great deal of erroneous judgment. The average farmer has no hesitation when the same principles are involved in buying land. He can see clearly enough then. If one field which will barely produce crops of sufficient value to pay the taxes, interest, and labor, which expenses must be met, is offered for twenty dollars an acre, and another capable of yielding large crops which will a great deal more than pay these expenses is offered for forty dollars an acre, he thinks it is the part of wisdom to purchase the best field. In this case he not only considers the relative cost of the land, but also its relative rate of production. The same principle should govern in the purchase of a cow. A twenty-dollar cow may just pay her way, while a fifty-dollar cow may yield a large profit. This is not always the case, it is true, and it must not be taken for granted that a high-priced cow is certainly a good one and will pay a large percentage of profit. But it is a settled principle that a good cow at a certain price is more profitable than a poor one which can be obtained for half the money.

But we do not advocate extensive and costly changes, all to be brought about at once, but a gradual improvement of the productive qualities of the herd. The poorer cows had better be fattened and sold for beef. Even though the owner does not feel able to buy any better ones he had better sell these. This may not leave him as many cows as he wants to keep, but he had better keep less than he wants than to have some which do not pay their way. Take out the three poorest cows from a

herd of ten, and the seven which are left will not make as much butter as they all did, but they will yield a much larger profit. The farmer cannot afford to keep animals which do no more than barely pay the cost of their keeping. He had better sell his hay and grain and buy commercial or other fertilizers than to do this. It is still better that he should sell his unprofitable cows, and, if he cannot afford to buy good ones, fill his stables or pastures with steers to be converted into beef. A great many herds which are owned by good dairymen need this same process of weeding out the poor stock.

Before any changes are made the owner should carefully test each and every one of his cows in order to determine accurately which ones pay him the best. Too many farmers wholly neglect this common-sense requirement, and form their judgment of the actual and relative merits of their cows wholly by "guess." They are, in this way, very likely to make mistakes, and they often sell cows which they afterwards wish they had kept. We have known a man to sell the best cow from his herd when he thought, and told the buyer, that he was disposing of one of the second-class.

Some cows which give a great deal of milk are supposed to be very profitable, while others which give less milk are thought to be much inferior. But the milk of the one giving a large quantity is watery and poor, while that of the other cow is rich. In such cases, unless the owner sells milk, the cow giving the smallest quantity is really the best. There are some cows which give but little milk, and, because they give so little, their owners assume that the quality is so fine that the cows are valuable, when a careful test would prove that the milk was poor instead of rich, and that the cows cannot pay for their keeping. There is no way of "guessing" with any degree of accuracy about the value of cows, and a "guess," even by the shrewdest observer, is often very far from the truth.

At one time a great deal of confidence was placed in an

instrument called a lactometer, but of late this has been proved unreliable. The only sure way of determining either the absolute or the relative value of the cows in the dairy is to keep the milk of each one by itself for a certain length of time, churn the cream separately, and compare the products. Even then allowance must be made for those which have been longest in milk since calving, but this seems to be the nearest to a perfect test of any which can be devised.

But though extremely valuable, the test of productive capacity cannot be called complete, and cannot alone fully settle the question which is the best paying cow in a given herd. The cost of keeping must also be considered. This is often overlooked. The farmer says that he feeds his cows alike, and, therefore, it must cost about the same to keep one that it does to keep another. But the manner of feeding on the average farm is not very accurate, and one cow may eat a third more hay than the one standing next to her, and yet the owner think that he feeds them pretty nearly the same amount. If a cow is very "hearty," the owner usually puts more hay into her manger than he does into the manger of one which does not have so good an appetite. He does it as a matter of course, and thinks but little about it. The one which eats the most hay may give the most milk, and yet not pay as well as the other because she may not give as much milk in proportion to the food consumed.

PROF. ARNOLD has done a good thing in calling the attention of farmers and dairymen to this fact. This argument is mainly directed to the proof that small cows are more profitable than large ones, and he conclusively shows that it is very expensive keeping large cows for milk when small ones will answer the same purpose. The difference in the cost of keeping two cows, one of which weighs twelve hundred and the other eight hundred pounds, he places at ten dollars and twenty-two cents per year. This is probably below rather than above the average

cost. Whether the large cow will give enough milk in excess of what the small one will produce to make up for this extra cost of keeping is one of the points upon which the question whether the large or the small cow is the most profitable must turn. If both cows give milk of equally good quality it is *the* point which must govern the decision. PROF. ARNOLD has given some illustrations of this principle in a description of three herds of cows which he has examined. In one herd of large cows, estimated to weigh twelve hundred pounds each, the annual yield of butter per cow was three hundred and fourteen and a half pounds. Another herd of native cows, estimated weight ten hundred and fifty pounds each, gave an annual yield of three hundred and two pounds of butter for each cow. Another herd of twenty-five small cows, JERSEYS and their grades, the live-weight estimated at seven hundred and eighty pounds each, gave an average product of two hundred and thirty-four and a half pounds of butter in a year. The herd last named produced but a small quantity of butter when compared with the others, and most farmers would say, and very naturally, that the yield was too small to be profitable. But PROF. ARNOLD shows that it was the best paying herd of the three. The small cows produced three-tenths of their weight in butter, while the others fell considerably below this standard. As "the consumption of food is in proportion to live-weight," it is plain that the smallest cows were more profitable than the larger ones, and that the owners of the large ones were obliged to support much more live-weight than was either necessary or desirable.

The test of cows, and their selection when bought, should be governed strictly by considerations affecting their dairy qualities, and without regard to their use for beef after age has impaired their productive powers. A good cow ought to be milked ten or twelve years, and it is not wise to make a great deal of calculation on extra value for beef at the expiration of

that length of time. The extra value of a large cow over a small one for beef would not pay the extra cost of keeping three years, and it is plain that in the long term which the dairy cow ought to serve, the cost of keeping would be very much in excess of the value of the extra quantity of beef obtained.

While it is an object for farmers to keep small cows in order to reduce to the lowest figure the expenses of maintaining them, it is very important that the cows should be healthy and vigorous, and possess strong digestive powers. The object in view is not to obtain animals which will live on the smallest possible quantity of food, but to secure those which will make the most profitable use of the food consumed. Dainty animals, which eat but little, and want that to be of the best possible quality, are not to be recommended. No animal can be productive without using considerable food. The good cow will usually eat heartily. The more she can eat, thoroughly digest, and economically use, the better. Good digestive powers are among the principal requisites of a really profitable dairy cow. Any animal that does not digest its food well cannot use that food to good advantage. It makes little difference whether the quantity is large or small, much of the food will be wasted, and the animal will be unprofitable.

As has already been intimated, it is one thing to decide what style of cows are wanted on the farm, and quite another and a much more difficult one to obtain a sufficient number of those which will prove satisfactory. That the average cow is very far below the proper standard of excellence no one will deny. That better cows should be secured, if possible, is equally evident. To fully effect the desired improvement will take some time, but it can and should be accomplished. The best method has already been partially indicated. Beginning with the best cows which he has, or is able to obtain, let the farmer raise his own calves and grow them into cows. Just as long as he depends upon the drovers for his cows, just so long will he have an inferior herd.

If he is selling milk, let him obtain, either alone or in company with his neighbors, a good *AYRSHIRE* or *HOLSTEIN* bull. If he is making gilt-edge butter, a good *JERSEY* bull should be secured. By careful breeding, in the manner already described, good cows, adapted to the special purpose for which they are wanted, can be obtained. Heifer calves should be raised which come from the best milking stock, but none from inferior cows, even though of good parentage on the other side, should be kept unless with the design of converting them into beef, if they do not seem especially promising after having the first calf. A cow from really good milking stock which does not do remarkably well the first season, should have a longer trial, as there is, in many cases, a great improvement during the second and third years. After a fair trial, any cow which is found wanting in good dairy qualities should be fitted for and sold to the butcher.

FEEDING COWS.—While there can be no success with poor cows, there is an equal impossibility in making the dairy business profitable, when the cows are poorly fed. Careful feeding will not make a poor cow equal to a good one which has an equal chance, but it will cover many deficiencies, and will give a degree of success with cows of moderate merit which cannot be obtained with extra ones when this is neglected. If the cows are good, the rate of production will depend very closely upon the quantity and quality of food which they receive. The best cow in the world cannot extract a great amount of richness from bushes or from swale hay. She may have plenty of food of either of these descriptions, or a mixture of both, but she cannot give a large quantity of milk, and the quality of what she does produce will be similar to that of the food from which it was made. While some cows will convert the same kind of food into milk from which much nicer butter can be obtained than can be made from that of other cows, it is still true that the quality of the milk will be very greatly affected by the quality of the food and water which the cow receives.

At all times the food of the dairy cow should be sweet and clean. It should be rich in quality, and liberal in quantity. When the grass is fresh and abundant in the pastures, it will hardly pay to feed grain of any kind. It is true that the use of grain will largely increase the flow of milk and the quantity of butter, but we do not believe it is best to force production to so great an extreme. Many dairymen feed meal during the summer, and it may pay in those cases in which the pastures are very poor. In other cases we think it must prove injurious to the cows. The present gain of such a course will be more than offset by a loss in the future. Cows which are crowded too hard give out much sooner than those of which too much is not required. With the highest feed, and crowded to the utmost limit, a cow will begin to fail at a time when she ought to be in her prime. When a cow reaches the age of nine or ten years, she will endure high feeding much better than she could have done earlier in life. But all crowding and forcing in early life must be very injurious. That it may pay, under certain circumstances, to crowd cows hard, and then fatten them when they are seven or eight years old, we do not deny. We know a man who keeps his cows only two or three years. He buys those which are matured, but which have never been fed very well, crowds them up to the highest possible rate of production, uses them up for milk in a short time, then sells them and buys a new lot. He thinks it pays him to follow this method. In some cases it may pay, but for the average farmer we consider it a poor policy. The cows must be well kept, but they need not be spoiled by over-feeding.

In connection with this matter of feeding, the importance of good health of the cows is very evident. The milk of the cow is made either from her food or her flesh. The latter is not admissible as a source of supply, as the cow would grow poor very rapidly and decrease in value. From the food and water alone the milk should be made. If the cow has strong diges-

tive powers, she will obtain much more material for milk from a certain quality and quantity of food than she can if her health is poor and her powers of digestion are weak. But even here is where many farmers incur a loss. They have strong, hearty cows which eat whatever is placed before them, and no effort is made to lighten the work of digestion. Cows fed in this manner cannot do their best. All the vital force expended in the work of digestion is a direct loss to the work of production. The man who prepares the food of his cows so that it can be easily digested thereby secures from them a larger quantity of milk than could be obtained from the same amount of food if offered in its unprepared state.

Many farmers keep their cows wholly upon hay, and they think that if the hay is good they are feeding very well. Others mix some straw with the hay, and think that such food is plenty good enough. But a cow cannot digest hay very readily. She certainly cannot digest enough to make a large quantity of milk. As for straw, PROF. ARNOLD has well said, if cows "give milk when eating straw, they draw much upon their own resources and little on the straw." Grass is much more easily digested than hay, and in this fact we have a partial explanation why cows do so much better in summer than they do when kept on nothing but hay in the winter. In the summer they have plenty of food and digest it all, while in the winter there may be food enough in quantity, but much of it is indigestible. The difference in temperature also exerts quite an influence, but in warm stables it does not account for all the falling off in production, which is noticed when only hay is fed. We do not think that either farmers or dairymen can *afford* to feed their cows with dry hay alone.

No domestic animal does its best with any one kind of food. The more indigestible matter the food contains the greater will be the evil of giving only a single kind. We believe in feeding cows well, in giving them a variety of easily digested food, and

in protecting them from cold and storms. We have already explained why it costs more to keep animals which are unduly exposed to the weather than it does those which are protected. In the case of cows giving milk there is a still farther loss, as "the secretions are always disturbed by influences that cause pain or uneasiness, and every shiver of a half-frozen cow will make itself visible in the milk-pail." The cold not only compels the cow to eat a larger quantity of food, or, if this is not supplied, to use an undue proportion of what she does receive for keeping up the animal heat, but it also directly reduces the quantity of milk which under more favorable circumstances might be formed.

Not only is the theory advanced very plausible, but it is proved by a multitude of facts to be correct. Wherever a cow is found which yields large returns, it may be confidently asserted that good food and careful attention are regularly given. Such care and feeding *pay*, and when farmers are careful to give them, they will find their dairy business much more profitable than it has been in the past.

In the early part of summer a little bright hay may be given in connection with good pasturage, and a little meal may be added if the pastures are poor. When the freshness of the grass has been impaired, and the quantity diminished, the free use of fodder-corn, millet, or some similar substance, should not be omitted. As soon as the quality of the grass has been injured by the early autumn frosts, hay should be given at the barn. For winter food, good hay, corn-stalks, INDIAN meal, shorts, cotton-seed meal in small quantities (two or three pounds per day), and roots, will answer every purpose. There should be no sudden changes in the quality of the food, but cows like a variety of articles, and will give more milk if fed in this way than they will if only one or two things are supplied.

COOKING FOOD.—Whether it pays to cook food for cows is a question upon which there is a great difference of opinion.

PROF. E. W. STEWART is a strong advocate of the plan. He is an authority upon dairy matters, and his extensive and careful experiments in this particular department of the business entitle his opinions to a high degree of respect. He believes that "half hay and half straw, mixed and steamed, more than equals hay unsteamed. When cows are kept in milk through the winter, cooking their food will greatly increase the yield of milk." He estimates the saving of food per cow for the season to be eight dollars. This is a very favorable showing, and many other parties who have followed the same course have been highly pleased with the results. The theory is that the food which has been steamed is more easily digested than it otherwise could have been, and also that much of the food which in its natural state would not have been digested at all is, by this process, made available.

But, on the other hand, many intelligent farmers have tried the plan of cooking food for cattle and found it, as they thought, unprofitable. In the *SCIENTIFIC FARMER* for December, 1877, an article appeared upon this subject and a comment by the editor. The writer of the article said: "One after another of the advocates, or at least those who make trials of steaming food for cattle, give it up. I doubt not that one can now find more apparatus out of use and rubbish than can be found in use. . . . Among those who have abandoned cooking, I observe from an article in the *COUNTRY GENTLEMAN*, is MR. I. W. WEBB, near NEW HAVEN. He formerly cut and steamed fodder corn in mixture with maize meal, but now serves the uncut fodder by itself, and finds that his cows relish it well and eat it as clean as they would hay. The meal is given separately, but regularly. I could name a dozen persons who have accepted in theory, then in practice, this cooking notion, and who have now rejected it in practice." To this, the editor, DR. STURTEVANT, whose labors in the interest of profitable farming have been of immense value to the country, appends the following note: "On Waushakum

Farm steaming of food has been on trial; and many tons of hay and of corn stover have been cut, at times into quarter, or one-half inches, or two inch lengths; this sprinkled with various meals—sometimes one, sometimes another—and the whole steamed. The cows relished the food well. Little or no food was wasted; but in recent years we have been feeding our cows after the manner described by MR. WEBB; and we think the cows like it as well; certainly we do.”

As far as theory goes it is strongly in favor of cooking food for cows, but, as already indicated, the practice of able and careful men, and their deductions from that practice, differ widely. We have endeavored fairly to set forth the opinions held by each class. For ourselves we think cooking food must be advantageous. It will involve considerable expense, but on large farms the apparatus would be valuable for other purposes, and thus greatly reduce the cost of preparing the food.

For small farms we do not think elaborate methods would be found profitable. The fodder would be improved in quality, and less would be wasted than with the ordinary system, but the cost would be too high. For such farms a partial adoption of the system is to be recommended for trial. Cut the hay and then throw on boiling water, sprinkle upon it a quantity of meal, mix well together, and feed as soon as it is cool. We have tried this method and like it very much. It is to be especially recommended when a low quality of hay is used and when straw must be fed. By using a half hogshead with a close fitting cover and allowing the hay to remain covered for a few minutes after the water is applied, some of the advantages of steaming may be obtained. The hay will be softened, it will be more easily digested, and cattle will like it better than they will if fed in the ordinary manner. This plan involves some work, but we believe that farmers who keep only a few cows can make it pay them well.

PURE WATER is almost as essential to the health and comfort

of cows and the success of their owner in the dairy business as good food. A cow that is obliged to drink impure water, or is kept on a short supply of that which is good, cannot give as much, or as good, milk as she could if she was properly watered. It has been proved that impure water injures the milk, often imparting to it poisonous qualities, and renders cows liable to various diseases. An insufficient quantity of water makes the production of a large quantity of milk impossible. Experiment has proved that cows which are well fed but which have but little water to drink give only a little milk. In one instance, cows which were kept well with the exception of having only a small quantity of water gave from nine to twelve quarts of milk per day, but immediately increased the quantity to from twelve to fourteen quarts per day when their food was thoroughly moistened and they had all the water they could drink. The quality of the milk produced after the water was given was found, by analysis, to be very good, and a fine quality of butter was made from the cream.

In many farm-yards the cows have water enough at some times and suffer severely for want of it at others. When the weather is fine they are out during the day and can drink as often as they choose. But in stormy days in winter they have only one opportunity to drink. They are then put in the stable and kept there until the next day. They become very thirsty, and, when they get to the tub, they drink a large quantity of water. This water is very cold, and not only chills the cow, but its excessive quantity injures the digestive organs and lays the foundation for, if it does not at once produce, serious disease. While plenty of water ought always to be supplied, it should be given so often that it can produce no injurious effect.

During the summer most of the cows are well supplied with water as far as quantity is concerned, but the quality is often poor. Drinking from stagnant ponds is very injurious to the cows, injures the quality of their milk, and often carries disease

and death to the people who use it. This is especially true when there is a drought. Then the water is partly evaporated, and the air is tainted by the poisons contained in the mud with which the edges of the pond are lined. A clear spring, or a good well, should be found in every pasture.

KIND TREATMENT.—While all animals ought to be kindly treated, there are but few which repay kindness better than the cow. While kindness tends to increase the rate of production of milk, bad treatment as strongly tends to reduce it. The man who ill treats his cows not only does wrong, but he thereby involves himself in a direct and unnecessary loss. At all times cows should be treated kindly and gently. No whipping or pounding should be allowed in the yard or elsewhere. Dogs should never be allowed to chase or worry the cows, and if the boys try to run them to and from the pasture they should be convinced that, for themselves at least, such a course is neither wise nor profitable. The milking should be done quietly and gently. If the cow is bad-tempered she should be put into the stable at milking time and one forward foot strapped up or else both hind legs fastened together. Most cows will be quiet if they are always well treated. Some are very “high-strung” and resent an injury at once, but if treated well they will seldom make any trouble. A few cows are really ugly and ought not to be kept either for breeding purposes or for milk. But there are very few cows which are troublesome which have not been made so by bad treatment at some time in their lives. A heifer that is frightened, whipped, and abused, will be very likely to become a troublesome cow. But kind treatment in her early days might make her gentle just as easily as bad treatment makes her vicious.

Many cows are made ill-tempered by being badly treated when they have sore teats. It is not at all natural for a cow to stand still and allow a man to hurt her severely. If a man tries to milk her and in the effort causes her much pain, she will try

to get away from him. For this she should not be blamed. Instead of following her around the yard two or three times, talking loudly and pounding her with the stool, the milker should be gentle and cause her as little trouble as possible. After milking, some ointment, made of one ounce each of spermaceti and almond oil melted together, should be applied to the sores. PROF. LAW recommends this for mild cases. For severer ones add five grains of balsam of *Tolu*. "Or, a solution of five grains of sugar of lead, or chloral-hydrate, and one-half ounce each of glycerine and water. But no plan will succeed without gentle milking, with dry teats, especially in winter, or in bad cases without the use of a milking tube." Something of this kind should be used at once, as neglected sores, even though very slight at first, sometimes prove a permanent and very serious injury to the health of the cow.

THE MILK should be drawn regularly, quietly and rapidly. Cows which are milked at certain hours each day yield a larger quantity than they could if there was no particular time for doing the work. No loud talking should be indulged in while milking, and the work should be done as rapidly as possible. A slow milker will get a cow into bad habits about being milked and will tend strongly to dry her off. It is very important that the work should be done thoroughly. The milk which is obtained last is much the richest and best which the cow can give. Besides, if milk is left in the udder it tends to reduce the quantity secreted, and, being absorbed into the system, proves injurious to the health of the cow.

During the operation of milking the greatest care should be used to secure perfect cleanliness. This is one of the great essentials. If neglected, pure milk cannot, by any possibility, be secured, and from the milk which is obtained a nice quality of butter or cheese cannot be made. As an aid in keeping the milk pure the pail illustrated by Figure 101 is of great value. This pail is made by the DAIRY SUPPLY CO., of New York city,

and is a stool, pail and strainer combined. By the use of this pail the milk is strained as it is drawn, all dirt is excluded, and the milk is "quickly and perfectly placed beyond the reach of the foul odor of the stable."

As soon as the milk is drawn it should be taken to the house. A pail of milk left standing in a stable will, in a few minutes, be tainted by the impurities which it will absorb from the air and can never be made perfectly sweet again. The stables should be clean and well ventilated. If these essentials are neglected the milk may be injured before the pails are filled. But the cleanest stable is no place for keeping the milk after it has been drawn.

Within a few years there has been a great deal written about the "animal odor" of milk, and various methods for getting rid of it have been proposed. As MR. HARDIN, of KENTUCKY, has well said, these writers "start out with the idea that milk is naturally full of vileness that must in some manner be gotten rid of." Now it seems plain that such an idea must be wrong.



FIG. 101.—THE PERFECT MILK-PAIL.

Milk from a healthy cow is a pure article and is one of the most perfect kinds of food, both for children and adults, in the world. That it will in time decay is true. But this proves nothing concerning its original condition. All other animal substances, when separated from the body which gave them vitality, soon perish.

We think the milk is well enough when first drawn, and that if kept in its original purity it will remain good for a considerable length of time. This, however, is on the supposition that the cow is well and that the milk has not been tainted before being drawn. It is possible for the milk to be spoiled by impure water which the cow has drank, and by bad odors in the pasture in which she feeds. The latter may, to some of our

readers, seem almost incredible, but it has been proved many times and beyond all possible doubt. The putrefying remains of an unburied calf have caused an odor which has spoiled the milk of the cows kept in the vicinity. On this account, and also in order to prevent disease among men and animals, all dead bodies should be deeply buried.

The cause of the rapid change which milk undergoes in hot weather should be briefly considered. It is the generally received opinion that all decay is caused by the development and growth of living organisms. These fungi belong to the vegetable kingdom and are so minute that they can only be discovered by the aid of the microscope. PROF. CALDWELL, in giving the opinion held by scientific men upon this subject, says that "the dust of the atmosphere, as well as all fermenting or putrefying matter, contains either the germs of the microscopic fungi, or the fungi themselves in one stage of development or another; that these germs fall on all substances exposed to the air, and that if the substance so exposed is one that can nourish their further development, they will vegetate and increase, and in so doing cause the substance itself to decompose—that these fungi, like all others, and like all plants, require moisture and a moderately elevated temperature for their growth, as well as food for their sustenance—are killed by exposure to a temperature of two hundred and twelve degrees, FAHRENHEIT, and that they live at the expense of a portion of the substance in which they grow, while the rest is decomposed, that is, fermented or putrefied, with the final result of the breaking down of the whole structure." If we consider the milk as it comes from the cow to be perfectly pure, and subject to the same conditions as all other organic substances which have no life in themselves, we shall see why, even with the greatest care, the best of milk goes through various changes, becomes sour, and is finally spoiled. If we also keep in mind the facts presented concerning the presence of the germs of microscopic fungi in the air and the rapid-

ity of their growth and development when they have "moisture and a moderately elevated temperature," and remember that milk has very strong absorbent powers, we shall readily understand why milk that has been exposed to the air, and especially to the impure air and foul odors of an unventilated stable, goes so quickly through the changes incident to decay and also why milk keeps sweet so much longer in cold weather than it does in summer.

Various expedients have been devised for keeping milk sweet and pure. The first thing to be done is to see that the pastures and yards are kept free from all bad odors; the second to use the utmost care while milking, to keep all dust and dirt from entering the pails; the third to remove the milk from the stables as soon as it is drawn; and fourth to take care of it after it is carried to the house. These are all very simple things, but if any one of them is neglected, the milk will certainly be injured, and may be spoiled.

If the milk is to be carried off and sold, it should be cooled before being transported. This will prevent the rapid separation of the cream and milk, and also prevent the destruction of the globules by the agitation which it receives. The same process is to be recommended in case the milk is to be taken to a factory. The cooling is to be effected by placing the milk in a can, and the can in a larger vessel containing cold water or ice. Whether the can containing the milk should be open or closed during this operation is a question upon which there is much controversy. If the milk has received no bad taint, we think closed vessels should be used. If the milk is already tainted, and the air is reasonably pure, open cans may be the best. But if the air is impure, and the milk is exposed to its action, this exposure will add to, rather than subtract from, the existing evil. Which plan will be the best will therefore depend upon the actual and relative condition of the milk and the atmosphere.

Farmers and dairymen who deliver milk at cheese or butter factories will find a good scale a great convenience. It will prove very useful in enabling the owner to determine the rate of production, as far as quantity is concerned, of each cow giving milk. By its use he can also find the quantity of milk which is given each week, and the aggregate during the entire season. For these purposes, Fairbanks & Co.'s dairyman's scale, Figure 102, is unsurpassed.

CHEESE-MAKING.—If this important branch of the dairy business is to be conducted on a large scale, the farmer should,

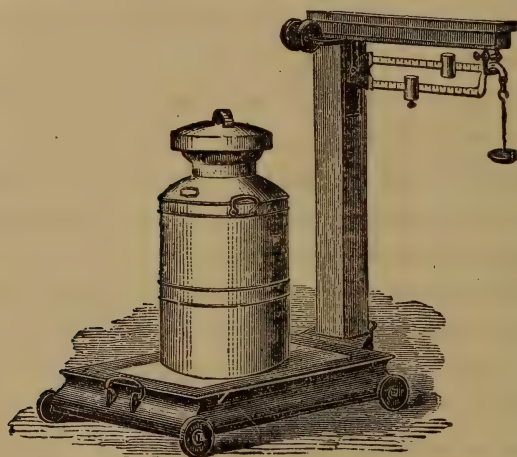


FIG. 102.—DAIRYMAN'S SCALE.

by all means, patronize a cheese factory. If there is none in his immediate vicinity, let him talk the matter over with his neighbors, and induce them to unite with him in establishing one. This for various reasons. More cheese can be made at the factory from a certain quantity of milk than can be obtained at home. The cheese will be of a more uniform flavor, and the product will sell better in market. Last, but far from being least, the labor of cheese-making on a large scale is altogether too severe for the women of the household to perform.

Many farmers do not like to buy cheese, yet they and their families want it occasionally upon the table. Such parties

can make a small quantity during the hot weather in summer without a great deal of labor or expense. MR. WILLARD has suggested that when three or four neighbors are situated in this manner, they had better work in partnership, and deliver "a certain quantity of milk daily at some central neighbor's house, where the cheese is to be made. There will be no very great trouble in this, and by assisting each other all may be supplied. As the labor in manufacture will be no more for ten pails of milk than for four, and as the cheese can then be made up at once, it will be advisable to associate together whenever practicable." This we consider excellent advice.

In the handling of milk designed to be made into cheese, a great deal of care must be taken to prevent its becoming tainted. A slight taint of the milk injures the quality of the product, and a strong taint may utterly spoil it, making the cheese both unfit and dangerous for use as food. Care and cleanliness must be observed in all the various processes of manufacture. Boiling water—not warm water nor hot water, but water which *boils*—must be used freely for cleansing the vessels which are employed. Then, after the cheese is made, there will be need of watchful oversight to keep it from injury.

The various kinds of cheese produced on the farm are made from the entire milk, from a mixture one-half of which is new while the other half has stood ten or twelve hours, and from which the cream rising in that time has been removed, and from milk which has parted with nearly all of its cream. Of these three kinds, when the making has been properly attended to and the materials were good, the first is rich, of good flavor, and an excellent article of diet. The second is devoid of the richness which characterizes the first, but is reasonably healthful, and has a fair flavor. The third is an abomination. Those who like it, whose teeth are sharp and jaws are strong, and whose digestive powers no substance can weaken, are at perfect liberty to eat this kind of "food," but all other parties had better let it

alone. It may be well for strong, active laborers who work hard in the open air ten or twelve hours a day, and whose food does not "stay by" them well to eat this kind of cheese, but it is wholly unfit for children, and for all persons of sedentary habits and occupations.

The following plan for the manufacture of cheese on a small scale we partly learned from experience and observation, and partly from MR. WILLARD'S excellent work on "PRACTICAL DAIRY HUSBANDRY."

For this work there will be needed a round cheese-hoop, ten inches in diameter and twelve inches high, with a follower; a new wash-tub, or something which will answer the same purpose, and a press. None of these need be very costly. The farmer who understands the use of tools can easily make a press. The following directions are given by MR. WILLARD: "A very good press may be made in a few hours from a twelve-foot plank, and a few pieces of scantling. About a foot from either end of the plank set up two short pieces of scantling four and a half inches apart. Fasten them firmly to the plank with bolts or pins. The lever may be a joist, four by four, or four by six, and fourteen feet long. One end is secured by a pin passing through the uprights at one end of the plank, and it is to move freely up and down between the uprights at the other end. A weight hung at one end of the lever, and you have a press that will do good service. The weights at the end of the long lever are a stone or two from the field. There may be another lever arranged for raising the long lever or press-beam, without removing the weights, which are stationary." The cheese is pressed by placing the hoop, containing the curd, near the end of the press-beam which is fast, placing blocks upon the follower, and letting down the beam. A large bread-knife, or a long, thin wooden one, may be used for cutting the curd.

Having brought the milk to the house in a perfectly sweet

and pure condition, free from all dust and foul odors, it should be strained in the usual manner, and then carefully strained through a cloth into the cheese-tub. A gallon (wine measure) of milk should make nearly a pound of cheese. The exact quantity used at a time should be known. Part of the milk should be dipped into pans, which should be placed in kettles, or larger pans, containing a little water. This in order that the temperature of the milk may be increased without scorching it. Enough milk must be warmed to bring the heat of the whole, when it is all in the tub, up to eighty-five degrees. For coagulating the milk, rennet should be used. This should have been soaked for a while in water. Enough should be added to insure coagulation in forty or fifty minutes.

The quantity of rennet required must be determined by experiment. Rennets differ greatly in strength, and a given weight which would be sufficient if the quality was good would be wholly inadequate if the rennet was weak and poor. The richness of the milk also exerts an influence. The poorer the milk the larger the quantity of rennet which will be required. Too much rennet injures the quality of the cheese and prevents its keeping well. Too little retards the progress of the work, and makes the cheese hard and sour. It is important that rennets should be taken only from healthy calves. If good rennets of uniform quality are used, the person in charge will soon be able to determine the quantity with a sufficient degree of exactness to secure a pretty good and even grade in the product.

When the milk has coagulated, the finger may be put into the curd and slowly raised. If the curd readily breaks, it should be cut into blocks two inches square and allowed to remain for ten or fifteen minutes. During this time the whey will form. Then the curd should be gently broken with the hands, and allowed to remain another quarter of an hour. At the expiration of this time, part of the whey should be dipped

off and heated in the same manner as has been described for warming the milk. The curd should be gently lifted and broken until the pieces are quite small. Warm whey should be added until the whole mass reaches a temperature of ninety-eight degrees. The curd should be broken and stirred while the warm whey is being added. Then the mass may remain for half an hour, when it should be stirred again. This must be continued until the curd is firm, and does not hold together well.

When it readily falls in pieces after being pressed in the hand, the draining process may be commenced. A cloth-strainer should be laid over the tub, and the whey dipped off down to the curd. Then put the strainer on a basket, or a hopper, the bottom of which is made of slats, and dip the curd into it to drain. It should be broken up with the hands, and, when nearly dry, salt may be added at the rate of four or four and a half ounces to ten pounds of curd; the whole mixed thoroughly, and then put into the press. After remaining here from two to four hours, it should be turned and again put into the press. The next morning the cheese may be taken out, rubbed with a little melted butter which should be fresh and used while warm. The cheese should be turned and rubbed every day until it is cured. If the rind becomes dry, a little butter should be applied as before. When a cheese of large size is made, a tight cloth bandage should be put around the edge, but there is no necessity for doing this with small ones.

When but little milk can be had and a good-sized cheese cannot be made in a day, the milk obtained during two or three days may be used. That obtained each day is to be used as though there were enough for the purpose until the curd is ready for the hoop, with the exception that but little salt should be used. The curd made each day should be set in a cool place in the cellar. When enough has been secured, the curds which have been previously made may be treated with warm whey, broken

up, drained, mixed with the one just made, and all of them salted and pressed. In this way good cheese can be made by farmers who keep only one or two cows.

After cheese has been made it must be taken care of or it will soon be spoiled. It should be kept in a cool, *light* room, upon clean shelves, and should often be carefully examined. If any cracks appear they should be filled up with cheese which has been crushed so that it will spread like butter. After this is done a piece of thin but strong paper, which has been well oiled, should be laid over the place. The shelves should be occasionally washed with hot whey and the room kept perfectly clean. The turning which has been recommended must not be omitted for a single day until the cheese is cured. The whole surface of each cheese should be thoroughly rubbed when the turning is done. This is necessary to prevent injury by the fly which deposits its eggs upon the surface, and especially in any unfilled cracks which may be found. These eggs soon hatch out into maggots or "skippers" which ruin the cheese. If the cheese is rubbed thoroughly and the cracks are promptly filled, the fly will not do much harm. When the mischief has been done, the maggots should be cut out with a knife and destroyed. It is said that, if taken soon after the maggots appear, a thick oiled paper plastered over the part of the cheese which they inhabit will shut off their supply of air, and thus drive them to the surface. When this method is adopted the paper should be used two or three times in order to make clean work in destroying the intruders.

Good cheese will be fit for the table, if it has been properly managed, in from four to six weeks after it was pressed, but will improve in quality for several months. It is claimed by some writers that cheese is a very valuable article of diet, that it is almost as nourishing as meat, and that in proportion to the amount of food contained it is cheaper than beef. While it is hardly probable that it will, to any great extent, supersede beef,

it is good food for those whose digestive organs do not resent its use, and it is certainly a luxury in the best meaning of the term.

BUTTER-MAKING.—The butter which is made in this country comprises all grades, from the poorest which it is possible to produce to the very finest quality which can be found in the world. The quantity produced is immense. Not only is a vast amount consumed at home, but during 1878 the quantity exported was worth fourteen millions of dollars. Not only is the aggregate quantity extremely large, but in a very large section of the country the business of its production is carried on at almost every farm-house or in some adjoining factory, and almost every farmer is pecuniarily interested in this branch of the dairy business.

As a general rule butter is made in private dairies. The factory system which works so well in the manufacture of cheese has not been very extensively introduced. There are, in all, many factories, and they are quite successful. But there is no such pressing call for their establishment as has been made for cheese factories, and, though they will become much more common than they are now, we doubt if they ever monopolize the business. Butter can be made at home, in small or large quantities, with less trouble than cheese, and the labor which devolves upon the women of the household, though often very severe, may, by means of the improved methods now being introduced, be made light and pleasant. Under the old system it was necessary to work hard and use a great deal of care. With the best systems now in use the work is very much less, and the constant watchfulness formerly needed is not required. More than this. With the old methods there was a great deal of uncertainty in regard to the product. Sometimes the butter would be very fine, but at others, when so far as the work was concerned an equal degree of care had been given, the quality would be very poor.

The lack of uniformity in the quality of dairy products has been a great drawback to their profitable manufacture. The men who have been able to make good butter every week in the year have been able to sell for high prices. But the men who have carried good butter to the market one week and poor butter the next have not found a ready sale at prices which were wholly satisfactory. And it may be regarded as settled that the one great thing for which the butter-maker should strive is *uniform excellence* of the product. When this uniformity can be secured, and not till then, will the demand be steady, sales quick, and prices high enough to yield a large profit.

METHODS OF OBTAINING CREAM.—There are many different ways of obtaining the cream for making butter. We have neither time nor space to consider them all, and it would be of no benefit to our readers if we had. The most common methods are the following. The use of shallow pans for holding the milk, the use of deep cans for the same purpose, the use of very large open pans so arranged that the milk can be either warmed or cooled, and the use of closed cans submerged and cooled in ice water, or cooled partly by means of water and partly by cold air.

The first method is in common use. The others are innovations. They have found their way to quite an extent into dairy districts, and are in use upon many farms. The old method is open to many objections. One of these, and one which deprives it of all claim to excellence, is to be found in the fact that uniformity of quality cannot be secured. The butter will sometimes be good, and often be of second or third quality. The weather does, and must, exercise a great influence upon the quality of the butter which is made from cream which is raised in shallow pans. In hot, muggy weather the cream will not be as nice as it is when the weather is cool and fine. Changes in the temperature, and particularly in the electrical conditions of the air, also modify the quality and influence the quantity of the

cream obtained. In this method of setting a large proportion of the milk is exposed to the air.

We have already shown that taints from foul air are readily absorbed by milk. They are still more rapidly taken by the cream. It has often been asserted that thorough ventilation of the milk room was an absolute necessity. If the air were always pure this ventilation might be useful, but when the ventilation brings air from the stable, the pig-sty, and the cess-pool, it does not add to the quality of the butter which is made from cream exposed to the odors which emanate from these sources. It may be said that the farmer should keep his premises sweet and clean. This will be admitted, but the fact that "the wind bloweth where it listeth" should not be forgotten. A man may keep his own premises all right, and yet, when this system of shallow setting in open pans is followed, have his butter damaged by foul air which comes from the neglected yards and stables of his neighbors.

But even if the air could be kept reasonably pure there is no method which is not extremely expensive for controlling the temperature, and no means for preventing the spores with which the air is always supplied from coming in contact with the milk and hastening its decay. These germs of the microscopic fungi cause a great deal of trouble where their presence is not even suspected. It is true that by heating the milk to a temperature of two hundred and twelve degrees the germs in the milk at the time of heating are killed. But this, in a farm dairy, involves a great deal of hard work and requires a great deal of time.

In addition to exposing the milk to the injurious action of the air, shallow setting makes an immense amount of work. All the vessels used in the business must be kept constantly sweet and clean. To effect this where a large number of pans are used requires much time and hard labor. Where many cows are kept, and no help is employed in the house, it makes the life of the farmer's wife a ceaseless round of drudgery and toil.

For these and various other reasons shallow setting of milk is not to be commended. There is too little certainty about the quality of the butter, and altogether too much labor is involved. If an effort is made to control the temperature quite an expense must be incurred. If nothing of the kind is tried, the butter in cold weather will be very poor and there will be but little of it, while in hot weather a similar difficulty will also be encountered.

Here we may be met by the inquiry, what shall be done by those parties who have, and must use, only the shallow pans? To this we reply, have a room devoted to this special purpose. If the milk is kept in a room in which food is placed, or in which work is done, the butter cannot be uniformly good. If but few cows are kept, and the cost of heating a milk room in the winter is too great, a tight closet may be done off in the kitchen and in this the milk can be kept. We do not recommend this plan, but we have seen it tried with fair results and it is decidedly better than some methods which are employed. Be sure that the milk comes to the house perfectly pure, and then see that it is not injured afterwards. All the vessels in which the milk and cream are kept must be very clean. They need frequent scalding with boiling water. Never let the milk get very cold, and also protect it from extreme heat. Churn often, work the butter well, and do it up in attractive shape. In winter it may be necessary to add some coloring matter, carrots, or some preparation which is known to be both harmless to people and effectual for coloring, though if the cows are good and are well fed with good hay, meal, and roots, this may not be required.

Concerning the plan of deep setting but very little need be said. It was once thought that a certain quantity of milk set in shallow pans would yield considerable more cream than it would if put into deep vessels. But it has been found that this is a great mistake, and that if the proper temperature is observed, as much, if not more, cream can be obtained by the use of deep cans as can be secured under the old system. The advantages of this

plan are to be found in a saving of expense in buying pans, a great saving of labor in cleaning them, and in the possibility of obtaining a larger quantity of cream. Set in this manner, less of the milk is exposed to the action of the air, and there seems to be less danger of atmospheric taint than there is with milk in shallow pans. When, in addition to these benefits, there are the conveniences of cool spring water in which to set the cans in summer, and good arrangements for heating the milk in winter, the improvement over the old method is still more marked. There has been considerable opposition to the deep-setting plan, but it has steadily gained in favor, and would, doubtless, have become popular upon its own merits if it had not been adopted in connection with other great improvements, and thus brought to the attention of people more quickly than it could have been alone.

The use of large, open pans has been strongly recommended for large dairies where there were conveniences for heating and cooling the milk. These pans are made large enough to hold the milk of any number of cows which may be kept (not exceeding one hundred and fifty). Underneath, or by the sides and ends, there is a channel through which warm water flows in winter and cold water in summer, and by means of which it is easy to keep the temperature at the desired point. The use of these pans saves a great deal of hard labor, and we have seen excellent butter that had been made where they were used, but they are open to the great objection that quite a proportion of the milk is exposed to the action of the air. Still they are a great improvement upon the shallow pan system, both in respect to the labor required, and the quality of the butter which is secured.

The last method to be considered is that in which the milk is kept in closed cans, which are usually deep, and are kept surrounded with ice or cold water in summer. The cans are kept in boxes similar in shape and outward appearance to the

ordinary refrigerator. This method, with various modifications, has been patented by several different parties. Some submerge the milk in water, and claim that in this way only can the best results be secured; while others, who use less water, claim that so large a quantity is not required. The object in view is to get as large a quantity of cream as possible from the milk while it is yet sweet, and to obtain it in a short time. The two principal methods of this description which are now before the public are known as the "COOLEY SYSTEM," invented by MR. WILLIAM COOLEY, of VERMONT, and the "HARDIN METHOD," invented by MR. L. S. HARDIN, of KENTUCKY. We understand that another invention is approaching completion, and that it promises excellent results. But as it is not yet perfected, we can say nothing further of its merits. Neither do we wish to pass an opinion upon the relative merits of the two systems which we have named. Both are *good*, and an intelligent man can make first-rate butter, if he has good milk, with either one. Both have been thoroughly tested by competent parties, and been very highly recommended. That it will pay the farmer to obtain one of them, even though he may keep but few cows, we have no doubt. Before purchasing, the claims of each should be considered. There are some other systems somewhat similar to these, but, so far as we know, they have not been brought to the degree of perfection which these have attained, and some of the best of these rival methods are said to be infringements upon patents already secured by the parties named.

Both the HARDIN and the COOLEY methods require the use of a box and deep cans. The box resembles a refrigerator in looks, and produces a similar effect. In each the milk is cooled in order to prevent the growth of the fungi which cause souring and decay, and also to facilitate the rising of the cream. In fall, winter and early spring, they can be used without ice or fire. In the summer, ice should be employed, though cold water has

been used to some extent and proved satisfactory. That butter of much better quality can be made by this process than with any in which the milk is allowed to stand in open pans cannot be disputed, and the most perfect uniformity is obtained. With this plan, good butter can be made in August with just as much certainty as it can in June. As it is kept pure, and not allowed to ferment, the milk after it has been skimmed is much more

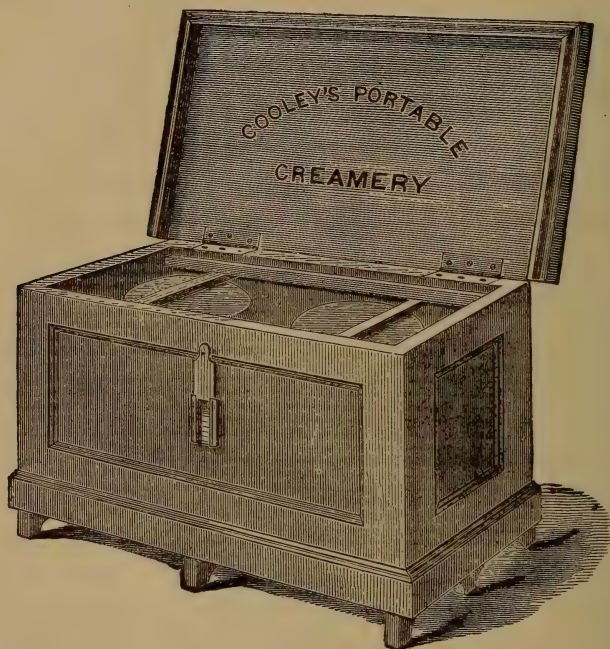


FIG. 103.

valuable for feeding to calves or pigs than it would be if treated in the usual manner.

Figure 103 shows the Cooley Creamery with the cans, and a thermometer to mark the temperature so that it can be seen without opening the box. Figure 104 gives a sectional view of the can and creamery. The implements used in this system are manufactured by the VERMONT FARM MACHINE CO., BELLOWS FALLS, VT.

The first cost of one of these portable creameries varies from

twenty-five to seventy-five dollars. This is much less than the cost of a suitable room, and the expense of ice in summer is more than made up by the saving of wood in winter. The whole apparatus occupies only a little room—a few square feet—and can be kept in an apartment which is principally devoted to some other purpose. Then the extra quality of the butter will add from five to twenty cents per pound to the selling price. Besides, it has been proved that a larger quantity of butter from a certain quantity of milk can be secured than is possible with the other methods of obtaining the cream.

The difference in the amount of labor and skill required with the open pans or the closed cans is very great. Every one who has had experience knows the trouble attending the use of pans. With one of the methods named, “the labor consists in getting ice once a day, lifting the cans of milk in the box and out again. The skimmer sits on a chair and uses a dipper.” In the washing of utensils there is an immense saving, as only about one-quarter as much surface is to



FIG. 104.—SECTIONAL VIEW OF COOLEY CAN AND CREAMERY.

be gone over, and that not nearly as often as with open pans. When the small pans are used, the skimming must be done at just such a time, or the quality of the butter will be injured. But with these deep, submerged cans the milk will keep sweet, and the skimming can be safely delayed many hours after the usual time.

Concerning the skill required Mr. HARDIN well says: “Where milk is set shallow, and subjected to all the variations of the atmosphere, in order to get the largest possible yield of butter from the milk, it requires excellent judgment to tell just when

to skim, and I have had persons who were proud of their butter yield tell me they often in hot weather got up at one or two o'clock at night to skim the milk, fearing it would be too sour by morning. With my method the atmosphere in which the milk is set is so pure and cold the skimming can be done whenever it is convenient, between thirty-six and seventy-six hours. A negro boy has exclusive charge of the milk of my dairy; he makes about three thousand pounds of butter a year; there is a wonderful uniformity in the butter he makes, receiving top prices, and the customers have never yet made a complaint, and yet I do not believe this boy could make a pound of good butter with the milk set shallow in the open air of summer." Certainly for inexperienced parties, for those who have no convenient place for keeping milk, and also for those who have all the work aside from butter-making which they are well able to perform, such a labor-saving method as that of MR. HARDIN'S, or MR. COOLEY'S, must commend itself as extremely valuable.

In the COOLEY method the cans containing the milk are entirely covered with water, and the cream can be raised very quickly. It is claimed that all the butter from the milk can be obtained in *four hours* if the proper conditions are observed. The capacity of the apparatus need not exceed that required for a single milking, as the cream can all be raised, taken off, and the cans got ready for use again between the usual hours for drawing the milk. In from ten to fifteen minutes the cans "can be removed from the water, set upon the bench, the milk run off, the cream emptied out, and the cans set back into the cooler, ready to receive another milking."

CHURNING.—After the cream has been secured in good condition the work of butter-making, though well begun, is far from being finished, and it is possible, by a little carelessness or an error in judgment, to neutralize all the benefit which has up to this point been gained. If the cream is allowed to freeze, or to become unduly heated, or the churn is not perfectly clean, or

constant care is not exercised to perform the remaining portion of the work in a neat and skilful manner, all the care which has been bestowed will be in vain. As already stated, *boiling* water should be used for washing the churn and all the other implements for butter-making, and they must all be kept perfectly sweet and clean.

The particular kind of churn which is used is not a matter of such great importance as some agents for patented styles would have the people believe. How it has been possible for inventors to obtain so many

patents upon churns is altogether beyond our knowledge. Many of these churns are good—nearly as good as the old-fashioned dash-churn of half a century ago. Some of them are *not* good. A few are really excellent. We have used the BLANCHARD churn several years. It is simple and effective, cheap and durable. The butter can be thoroughly worked and salted in the churn if desired. We like this much better than the upright dash-churn.

The "Davis Swing Churn," Figure 105, which is made by the Vermont Farm Machine Co., is also a first-class implement. This churn took the first premium at the International Dairy

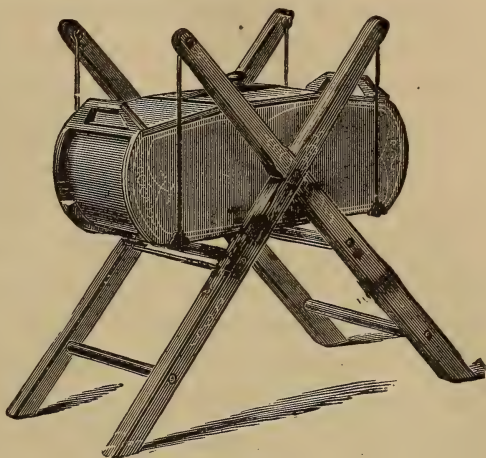


FIG. 105.—DAVIS SWING-CHURN.

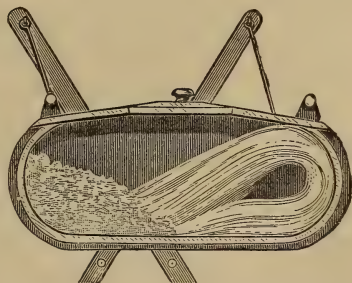


FIG. 106.—MOTION OF CREAM IN
DAVIS CHURN.

Fair in 1878 in competition with the leading churns in the world. It is quite simple, containing no floats or inside gear, and is very easily kept clean. Figure 106 represents the motion of the cream in this churn when in operation.

There are a few other excellent churns, but the larger number of the patents issued are either of no benefit or else positively injurious. It is a significant fact that the ORANGE COUNTY, NEW YORK, dairymen, whose butter has long been regarded as strictly first-class, have tried many patented styles only to lay them aside, and go back to the use of the old barrel dash-churn. This does not prove that there are no better churns than the old-fashioned kind, but it does indicate that there are many poorer ones.

There are some churns which will make a larger quantity of butter from a given quantity of milk than can be obtained from it by others, and the butter will be of equally good quality. It is unnecessary to say that the one which will make the most butter is to be preferred. Still, we have known a man to say, in reply to an invitation to buy a new churn, which it was claimed would produce considerable more butter from the milk than the one which he was using, that it did not make much difference with his folks. Everything was saved, and if the butter did not all separate from the milk it was no loss, as the buttermilk *was fed to the hogs*. He seemed to think, because the butter which was left in the milk was not thrown away, it was all saved. But if he had considered the fact that he could buy a pound of new milk, from which no butter had been taken, for three cents, while a pound of butter was worth twenty cents, he would have seen that the saving in feeding his half-churned milk to the hogs was not as great as he imagined. But it is not safe to try every churn which the agent claims "will make more butter than any other." If this plan were followed, the farmer would soon have more churns than he would know what to do with or where to find room in which to store.

A great many churns have been condemned, because they would not uniformly convert cream into butter without regard to the temperature or to any other conditions. The best churn in the world will not give perfect satisfaction, if no care is taken to have the cream in good condition. If the cream is either too cold or too hot, the butter will be long in coming, and if the variation from the proper temperature is excessive, the quality will be impaired. The temperature of the cream should range from fifty-five degrees in warm weather to sixty-four degrees in winter. In summer the churning should be done early in the morning. A thermometer ought to be used in every milk room. One made specially for the dairy is the cheapest, and for this purpose it is the best. If the cream is too warm, it may be cooled by placing it in a refrigerator, or putting the jar containing it into a larger vessel which is partly filled with cold water. Either way is better than putting ice directly into the cream. In winter the cream may be warmed by standing in a warm room (in a closely covered vessel), or by the addition of a small quantity of warm water.

The churning should be steady, and no effort should be made to obtain the butter in less than from twenty minutes to half an hour in the summer, and from forty minutes to an hour in winter. Violent agitation will convert the cream into butter in a much shorter time, but the quality will be seriously impaired. The appearances which indicate that a larger quantity of butter is obtained in this manner are deceptive. If the cream is a few degrees warmer than the standard we have given, the butter can be made in less time, but the quality will be seriously injured. We have given the extreme limits of temperature at which it is safe to churn the cream when good butter is required. MR. HARDIN recommends fifty-eight degrees in warm weather, and sixty-three degrees in winter, and his success is an indication that he has regulated the temperature of the cream in the best possible manner.

WORKING BUTTER.—Unless freed from the milk which remains mingled with it, the finest butter would soon be spoiled. For accomplishing the desired separation, various methods are employed. The very worst, yet very common, one is to work out the milk by squeezing the butter in the hands. The cleanest hands in the world are not fit to put into butter. There will be a perspiration, either sensible or insensible to the operator, which will certainly injure the quality of the butter,



FIG. 107.—EUREKA BUTTER-WORKER.

and also prevent its keeping well. The best way where no machine is employed is to use a ladle made for the purpose, and a wooden bowl or tray. There are many implements in the market for working butter. Some of these are excellent, but a few of them are constructed upon wrong principles, and are liable to injure the quality of the butter. All machines which operate with fluted rolls are, to some extent, open to this objection. Lever-workers, if care is taken to give an equal pressure the whole length of the machine, do very well; but the

implements with smooth rolls are probably the most perfect which have been devised. Of the machines made in this style we think the EUREKA, which is made by the manufacturers of the Cooley Creamery, is the best in the market. It is represented by Figure 107.

While it is important that the milk should be removed, it is possible to almost spoil the finest butter by simply working it too much. There should be an even pressure upon the butter, and all drawing and sliding motions are to be avoided. Some dairymen use brine in order to facilitate the separation of the milk from the butter, but this is not absolutely necessary. Much of the milk can be *washed* out if pure water is at hand. The following directions are from MR. WILLARD'S "PRACTICAL DAIRY HUSBANDRY." Gather the butter "with a wooden butter ladle in the tray or butter bowl, turn off the buttermilk and wash with fresh spring water. Gash it around the whole circumference, making channels lowest at either end, so that the buttermilk can readily run off. Do not grind it down against the tray, after the manner of tempering mortar, for in this way you will be likely to injure the grain. It is not well to attempt to work out all the buttermilk at once. But very little manipulation is required in washing out the buttermilk; then salt with pure, fine salt and set aside in a cool place for twelve hours, during which time the action of the salt will liberate more of the buttermilk. Then work a second time, either with the ladle or butter-worker, using precautions not to overwork or grind the butter by rubbing it down against the tray, and then the work is done and the butter is ready for packing."

SALTING BUTTER is usually considered necessary in order to improve the keeping qualities as well as to suit the taste of consumers. A nice grade of butter, properly managed in all the various processes of manufacture, can be kept a long time without salt. Still, most people prefer salted butter, and a few words in relation to the method of salting will not come amiss.

The very best grade of salt should be used. A great deal of good butter has been damaged by the use of an inferior quality of salt. As only a small quantity is required, the difference in cost between the finest and the ordinary grades of salt is not to be considered by the man who wants to make a really good article of butter. The salt should be intimately mixed with the butter so that the whole mass will be uniformly salted. The quantity used at the butter factories in the NEW YORK dairy districts is eighteen ounces of salt for twenty-two pounds of butter.

PACKING BUTTER.—If butter is to be kept for a long time, or is to be carried a long distance, it must be packed in jars or tubs. The stone jars are best if the butter is to be used at home, but they cannot be safely transported. If tubs are used they should be filled with boiling water and allowed to soak for twenty-four hours. They should then be filled with strong brine which should stand in them two or three days. Then it should be turned out, the tubs rinsed with cold water, and the sides rubbed with fine salt. After filling the tubs nearly full of butter, lay a clean muslin cloth on top, put in the heads, and pour strong brine through the plug-hole in order to fill all the spaces and perfectly exclude the air. Then put in the plug and keep the tub in a clean and well-ventilated cellar. Even butter which has been packed in tubs must not be kept in the vicinity of decaying vegetables, soap, and many other things which are found in too many house cellars. If the butter is to be kept long in very hot weather the brine should be changed once in two months.

A still more perfect way of keeping butter was described, some time since, in the NATIONAL LIVE-STOCK JOURNAL as follows: "Make a muslin bag, a little smaller than the tub, so that when filled there will be a space of one inch all round, above and below. Pack the butter, when ready, into this muslin bag, and place the bag in the tub, when the head should be put in,

if there is one, with an inch and a half hole in it. Fill the space around the bag containing the butter with strong brine, and then put in a plug reaching one inch below, so as to prevent the sack of butter from coming to the top. The sack of butter will now float in the brine and be absolutely excluded from the air. An ordinary cover may be used instead of the head."

SECURING ICE.—As we have highly recommended those processes of butter-making which require the use of ice for their most perfect working, perhaps a few words upon the best method of keeping ice may be useful. A few years ago it was generally supposed to be quite difficult to keep ice through the summer, even at the extreme NORTH, and an ice-house was considered too expensive for the average farmer. But of late the idea that ice can be kept only in costly and elaborate structures has been proved incorrect, and the number of ice-houses has increased a hundred-fold. One ought to be found on each and every farm, or else a good substitute should be provided.

Some writers recommend ice-houses wholly above ground, while others consider it best to have a room partly underground. Practically, either plan works well. If only a small quantity of ice is needed, a room may be done off in a wagon-shed, a corn-barn, or in a clean basement room in either of these buildings. A great many farmers have practiced these methods successfully. A bin, with double walls and the spaces between them filled with saw-dust, or tan-bark, can be made to do good service. It should be nearly square, and the cakes of ice should be packed as closely as possible. Around the sides, and in the spaces between the cakes, saw-dust should be used, and the top of the pile should be covered a foot in depth. MR. HARDIN, though living far SOUTH of the line above which the principal part of the dairying in this country is done, uses an ice-house "which is about twelve feet cube, a mere hole in the ground with shed over it, and it has supplied an abundance of ice for the milk of fifteen to twenty cows." Farther NORTH there would

be less waste of ice by excessive heat. Ice costs but little, it is but little work to get it and keep it, and it is a real luxury as well as a very useful article. Therefore an abundant supply should be obtained. It will be useful for many other purposes than the special one for which it is provided.

The quantity required for keeping the milk at the proper temperature will vary in different localities and with the degree of protection from heat which is given in other ways. MR. HARDIN uses about "one pound of ice an hour to the one hundred pounds of milk." Farther NORTH less than this quantity would suffice. The COOLEY system, using water in part, is said to be still more economical of ice, though this is doubted by some who have experimented in this direction. It is not a matter of much consequence which method requires the largest quantity, for any farmer can obtain ice enough without incurring much expense.

For the benefit of farmers who are far from rivers or ponds which will furnish a supply of ice, and to whom the labor and expense of transportation would be obstacles which they would not overcome, we quote MR. WARING's description of a house which "is so simple, and involves so trifling an expense that no man need have an excuse" for being without a liberal quantity of first-rate ice. "Select a place on the north side of some building; lay a floor twelve feet square on scantlings, one foot from the ground. Set firmly in the ground, near each corner, two posts, from four to six inches square, and about eight or ten feet long. When the weather becomes cold, place on the floor saw-dust, tan-bark, or rye-straw, to the depth of eight or ten inches. On the top place another floor of the same size, putting a curb *inside* the posts to keep the filling between the floors in its place. Next make a curb ten feet square and six inches deep, and fasten the corners with common gate-hooks. On a cold day place the curb on the centre of the floor, put in two inches of tan-bark, and dash water over the bottom until it forms

a coat of ice that will not leak. Fill the curb with water and let it stand until frozen solid. With boiling water thaw the curb loose, raise it to the top of the frozen mass, fill and freeze as before. Continue so doing until the mass is of the desired height. Place boards on the *inside* of the posts, and fill the space with tan-bark or rye-straw; nail boards on the *outside* of the posts and fill the space with rye-straw; cover the top with tan-bark to the depth of ten inches. Over the whole put a roof, to shield from the sun and rain. Cut and take the ice from the top. Ice can be thus kept the entire season. If a stream of running water can be turned into the curb, the labor of filling will be much lessened."

We believe that by following the methods which have been indicated it will be possible for the farmers and dairymen of the country to greatly improve the character and the productive capacity of their stock, and to obtain a great deal more milk than they now secure. The cost of this improvement and extra production will be so slight as to leave a large profit to the owner of the cows. The purity of the milk will be secured and its richness increased. With only a slight outlay, which in a short time will be all repaid by the saving which it will secure in other directions, the quality of the butter which is made can be improved to such an extent that all trouble in making quick sales will be avoided and the price will be considerably increased. By such a change both producers and consumers will be greatly benefited.

If he will bring care and skill to his aid the farmer can furnish good milk and nice butter for prices which consumers will be willing to pay and which will yield him a liberal profit. The dairy business is not overdone, and as long as our population increases as rapidly as it has for a few years past, and the foreign demand continues, it will not be unduly crowded. If the quality of our goods is improved without advancing prices to an extreme limit, the foreign demand will not only be continued but will be

rapidly increased. All the butter and cheese we can make, and make well, can be sold at a profit to the producer and all who handle the goods. And the farmer who is wise will seek in the direction of improvement of the quality of his products for the increased price which he desires. It is useless to look for it elsewhere, but here it may be easily found.

SOILING CATTLE.

LTHOUGH not applicable in all parts of the country, or to all cases in any part of it, the system of soiling cattle has certain advantages which commend it to the attention of the owners of live-stock who find the common method of management inconvenient or unprofitable. Where land is very fertile or very cheap, the soiling system may not prove advantageous. Many farmers are so situated that they would incur a loss by accepting its conditions. There are many others whose profits would be largely increased by its adoption. In the vicinity of villages and towns it will often pay. When the farmer desires to keep a large stock of cattle on a small area of land, no better method than soiling can be devised. And where manure is in great demand in order to improve the productive qualities of the land, the want can be at least partially supplied by means of the soiling system.

The plan has been extensively tried in EUROPE, and been tested by many farmers here. The majority of those who give the system a fair trial report a great improvement over the ordinary methods. It is a very simple method, and yet it requires constant care and a high degree of skill to manage the soiling process to the best advantage. Upon this point the HON. JOSIAH QUINCY, who did more than any other man in his day to make the plan popular, said: "The soiling process, beyond all others, requires vigilance and foresight." The man who adopts it for the sake of making his labor light will be

sadly disappointed. He may make his labor a great deal more profitable, but he will not make a saving in the amount to be performed.

The advantages of the system, as stated by its most earnest advocates, are "comfort, convenience and protection for stock and fodder." There is a saving of land and fencing, food is economized, the cattle are kept more comfortable than they usually are in a common pasture, an increased production of milk is secured, and the saving of manure is effected.

The objections to the system are that it requires very close attention and skilful management, that neglect of cleanliness during hot weather will be likely to cause sickness not only among the cattle, but also in the families of their owners, and that it increases the difficulty of keeping the milk pure and sweet. If proper care is given, health can be preserved, and pure milk can be secured. But during the hot weather farmers are extremely busy, and are apt to neglect what they consider the little matters pertaining to their business. In many parts of the country the adoption of the soiling system would render much of the land entirely useless. Most farmers now have under cultivation all the land they can properly manage, and if they were to keep their cattle up during the summer, the land which they now use for pasture would be wholly unproductive.

In order to help those who may desire to try this plan, and give them a correct idea of the kind and quantity of crops to be grown for the purpose, we will quote MR. WARING'S statement relative to this part of the system. "Early in the autumn, sow three acres of winter rye, to be cut from May fifteenth to June fifteenth. Early in April three acres oats, to be cut from June fifteenth to July first. Late in April, two acres oats or barley, to be cut from July first to July fifteenth. Early in May, two acres oats or barley, to be cut from July fifteenth to August tenth. Middle of May, two acres corn, to be cut from August

tenth to September first. Middle of June, the three acres from which rye has been cut to be sown with corn, to be cut from September first until September twentieth. Early in July, the first three acres sown with oats to be resown with barley, to be cut from September twentieth until the harvest of roots and cabbages furnishes a stock of green refuse, which will suffice until winter-feeding commences."

The above plan allows twelve acres for keeping twelve cows, and requires the growth of root crops outside of the regular operations of soiling. The roots which are grown are not to be fed until winter, but the tops are needed late in the fall. The reason for devoting so much land to the production of soiling crops is to be found in the fact that the soil was not in a high state of fertility. In ordinary seasons there will be a large quantity in excess of the amount required. This surplus product of the land can be cured and used for winter-feeding without involving much loss, while the large area sown provides for severe droughts and other untoward events which may greatly reduce the quantity of food which will ordinarily be produced.

In September three acres of the four which were sown in May to oats, or barley, and corn should be sown to winter rye in order to provide for the early crop of the next year. Aside from this the same order may be pursued in succeeding years. MR. WARING is confident that if all the manure made during the soiling season is used on these twelve acres year after year, they can be made, in time, so rich that they will support thirty cows during the usual pasturing season. Many farmers who own considerable land will prefer to make a larger part of it good rather than keep a few acres exceedingly rich. This they can easily do by taking a new place every two or three years for the production of their soiling crops. In this way they can surely and rapidly increase the capacity of their land for production.

Whether it will pay them to adopt this practice is a question to be decided after a careful consideration of both the advantages and the difficulties of the course proposed. Some men can make the soiling system extremely profitable, while others cannot. In many cases it will pay to feed green crops in the barn, and in others it will be best to plow them into the land without being to the expense of cutting and hauling. In many other instances the ordinary system of pasturing in connection with the tillage of half or two-thirds of the land, will be the best which can be followed. The circumstances and surroundings of each farmer should be taken into the account. No radical changes should be made without previous careful deliberation, and all such changes as the one under consideration should be gradually effected.

ENSILAGE.

THIS comparatively new method of preserving green fodder crops is now attracting a great deal of attention in FRANCE, and being introduced to some extent in this country. To M. AUGUSTE GOFFART, of FRANCE, belongs the honor of the discovery of this system, and by his persevering and skilful efforts it has been brought almost to perfection. For more than a quarter of a century he has been studying the problem which at length he has solved. In translating his writings, and bringing together many facts in relation to the subject of Ensilage abroad and at home, J. B. BROWN, ESQ., President of the N. Y. Plow Co., NEW YORK CITY, has done the farmers of this country a valuable service.

Ensilage is a French word meaning "the act of compressing into pits, trenches, or compartments called silos." It is also applied to the green crops so preserved. "Silo" denotes a "compartment used for storing green fodder in an air-tight manner." It may be an excavation in the ground, or a building wholly above the surface.

The object to be secured is the preservation in a green state of the fodder which is cut for the use of cattle during the cold weather. It is well known that by the process of drying, considerable of the nutritive value of the fodder is lost. Grass is known to be superior to hay, and green corn-fodder is universally recognized as superior to the dried stalks. That grass not only loses water but also passes through other changes is evident from the fact that it exhales agreeable odors while the process of drying is going on. The fact is also sufficiently proved by the difference in the effects of grass and hay when fed to cows which are giving milk. The diminution in the quantity of the milk, and the deterioration of the quality of the butter made therefrom, are abundant evidences that hay is much inferior to grass.

Not only is the quality of the grass, or other fodder, injured by the process of drying, but there is a great deal of risk of damage by exposure to storms. Then, too, even when it is secured in the best possible order, the dry fodder is comparatively indigestible. Cattle cannot masticate it as easily or as well as they do green food, and are not able to digest it as thoroughly, or assimilate it to as good advantage.

Ensilage as a method of preservation can be applied to all kinds of crops which are used green. In this country it will probably be of the greatest value in its application to fodder-corn and grass. It is with the former crop that the largest number of experiments have thus far been made.

In order to be fully successful in the preservation of green fodder, all fermentation must be prevented. This must be done by excluding the air. The fodder is to be cut into short lengths, placed in a pit, or in a tight room, and the top closely covered. When the silo is filled, the material must be closely pressed down. In his earlier efforts M. GOFFART followed this course. The tops were covered with earth, and fissures which afterwards appeared were immediately closed. But there was always found, when the silo was opened, a vacuum between the

fodder and the covering. As a result of this vacuum, which was caused by the settling of the fodder, the process of fermentation speedily set in, and the material could be preserved but a short time.

After many experiments, M. GOFFART found that by greatly diminishing the quantity of dry straw which he had mixed with the green corn-fodder, or leaving it out, by cutting the material into very short lengths, and by arranging so that it should receive a strong and *continuous* pressure, perfect success could invariably be secured.

Pressure must be strong and constant. This, because the material in the silo contains a large quantity of air which, if not expelled, will cause fermentation and decay. When first put in, this material is so elastic that merely treading it down will be of but little value. But in time this elasticity diminishes, the material settles, and, if pressure is not applied, the destructive processes at once begin their action. Therefore, there should be a heavily weighted plank covering for the top of each silo. A little space should be left between the joints of these planks for the escape of the air in the silo, and the covering should move so freely that it will follow the material as it settles, and thus maintain a uniform pressure.

When preserved by this process, no drying is required. Exposure to the action of the sun and air, even for a brief period, will be injurious. As soon as cut, the material should be brought from the field. It should then be run through a feed-cutter, which will make it very fine. The NEW YORK PLOW Co. make a machine for this purpose, which can be adjusted to cut into pieces from one-fourth inch to one or two inches long. Forty-two one-hundredths of an inch is considered the best length. As soon as a sufficient quantity is cut, the material should be packed into the silos, and covered an inch or two in depth with short straw. Then the plank covering should be put on, and heavily weighted in order to pro-

tect from the external air, and maintain a strong and constant pressure.

When the material is to be used the silo should be opened at one end, or side, and cut down vertically. The quantity removed at a time should be sufficient for the stock for only one day. The material should be taken from the silo from fifteen to twenty hours before it is to be given to the cattle. This in order that fermentation, which will make it more palatable, may commence.

That the system of ensilage will be fully successful in this country there can be no possible doubt. MR. FRANCIS MORRIS tried it with good results in 1876. The next season he secured a sufficient quantity to keep "nearly a thousand head of stock for over two months," while, in 1878, he more than doubled the quantity then obtained. Experiments by other parties, though on a smaller scale, have been equally successful.

We believe that this discovery will have a powerful effect in advancing the interests of the farmers and live-stock owners in the colder sections of the country. As it will enable them to supply their cattle with green fodder during the winter it will prove of great advantage. By freely feeding this material they can keep their young cattle growing rapidly and their cows productive, while a high degree of health will be secured to the whole herd. Then, by enabling the farmer to substitute green corn for grass, the capacity of his land will practically be very much increased. Land which now yields from one to two tons of grass may be made to produce many tons of fodder of a still better quality. Much larger herds of cattle can then be kept on a given area of land. As there will be more cattle there will also be a largely increased quantity of manure with which the grain and clover fields can be made extremely rich and productive. In the various departments of the farm there will be a great gain, and the profits of the business will be correspondingly increased.

SHEEP.

FROM the earliest ages sheep have been regarded as indispensable to the comfort and welfare of the human race. As civilization has progressed their importance has been more fully recognized and their numbers have been correspondingly increased. Long ago the ENGLISH people realized the value of these animals, and gave a great deal of attention to their improvement. By growing the wool at home, making it into goods of which the whole civilized world was in need, and sending the manufactured product abroad to be sold for high prices, the ENGLISH secured a very profitable trade with other nations, and, at the same time, rapidly advanced their agricultural interests.

Stringent laws were passed with the design of protecting the trade in manufactured goods. In the reign of QUEEN ELIZABETH "the exporter of sheep was, for the first offence, to forfeit his goods forever, to suffer a year's imprisonment, and then have his left hand cut off in a market town on market day, there to be nailed up to the pillory. For the second offence he should be adjudged a felon, and suffer death." In the reign of CHARLES SECOND, "it was enacted that no person within fifteen miles of the sea should buy wool without the permission of the king; nor could it be loaded in any vehicle, or carried, except between sunrising and sunsetting, within five miles of the sea, on pain of forfeiture." These arbitrary and outrageous laws were long ago repealed, but the ENGLISH have never lost their interest in the business of sheep-growing. At the present time sheep husbandry is said to be "the sheet-anchor of English agriculture," and the term does not over-state the importance of this department of the farm business in that country.

In our own land sheep yield a large income to their owners, and add an immense amount to our national wealth. But here the business is hardly begun. What is now obtained from this

source is but a fraction of what might be easily secured. Importations of wool and woollen goods now amount to many millions of dollars per year. This money ought to remain at home. Our people can grow all the wool they need, and their mills can turn out the manufactured goods for a lower price than they can be brought from abroad. There is now an opening for an immense and a profitable business. At the SOUTH and WEST sheep can be raised in immense numbers for low prices, and still yield a profit to their owners. Some of the leading men at the SOUTH see in this business a splendid opportunity to place upon a sure foundation the material resources of this section. At the WEST the business has already assumed large proportions, and proved a source of profit. In the EAST it must necessarily be conducted on a small scale, but sheep-raising is, and long has been, practiced by many of the leading farmers. In this business but a small amount of capital is required, and, if it is reasonably managed, the returns will be both quick and sure.

There are three special purposes for which sheep may be kept. These are for their wool, for their flesh, and for improving the soil. In some places it pays to keep them for the wool alone, in others for their flesh and that of their lambs, and there are some instances in which the improvement of the land which they effect pays well for all the cost of their keeping, and is the prime motive for which they are kept. But in most sections at least two of these purposes can be served, and in some localities all three may be combined. Where both the wool and flesh are in demand, the profit is large. When in addition to these the land upon which they are kept can be improved there is a still greater gain.

Although the price which wool commands in the market is quite variable, yet there is always a certainty that it can be sold for something near its true value. Wool is a standard article of commerce, and has a certain intrinsic value. It is not merely

a useful but it is also a necessary article. Besides, better than almost any other product of the farm, wool can be transported to all parts of this or to other countries. A car-load of wool represents a very much larger sum of money than a car-load of hay. Consequently the cost of transportation in proportion to its value is very much less with wool than it is with hay and other bulky material. The same comparison may be made with almost every farm product. At a time when the freight of wheat from CHICAGO to the seaboard cost eighty per cent. of its value, pork thirty per cent., and beef twenty-one per cent., only four per cent. was required for the transportation of wool. Besides, as the people throughout the country are in constant need of woollen goods in large quantities, manufactories of these materials spring up in all sections. Even now in the distant State of OREGON woollen mills are turning out some of the finest kinds of cloth, and supplying them at prices which are remarkably low. Probably the time will come, and it is very desirable that it should come, when the wool-grower in any particular part of the country can sell his wool to be worked up in mills located near his own home. Then a large part of the present low cost of transportation will be saved, and the great benefits which manufactures always confer upon agriculture when the two are closely united will be secured by our people in all sections.

The flesh of the sheep is rapidly coming into general use. It is easy to digest, and is more healthful than most kinds of meat. There is a saying to the effect that as the standard of civilization of a country is raised the use of mutton for food will gradually increase. This rule seems to have been closely followed in this country, and there is a strong indication that in the future it will prove strictly true. In our large cities the demand for mutton has increased fully as fast as the wealth and numbers of the people could lead one to expect. The call for lambs in city markets increases year by year, and in some of the older-settled States it has become quite a business to supply this want.

There can be no doubt that the flesh of sheep and lambs will continue in demand, and that this demand will not only be permanent but will admit, and require, a steady growth in the line of production.

There are certain reasons why this line of business, viewed merely from this one point, holds out special inducement for farmers who are in the vicinity of thickly settled towns and cities. The returns are both sure and quick. A lamb dropped in January or February can be got in good condition for the market the following June or July. A sheep can be sheared in the summer and fattened on grass and roots so as to be sold in December, or it may be fed with grain during the winter and sent off in March or April. With cattle the case is very different. The calf must be kept from two to four years before it can be sold for a full price as beef. The cost of keeping all this time is considerable, and there is quite a risk of accident and disease. If sold while a calf the price per pound is below that of a lamb, and the cost of keeping him the five or six weeks which are required to convert him into good veal will be greater than that of keeping the lamb until he can be sold.

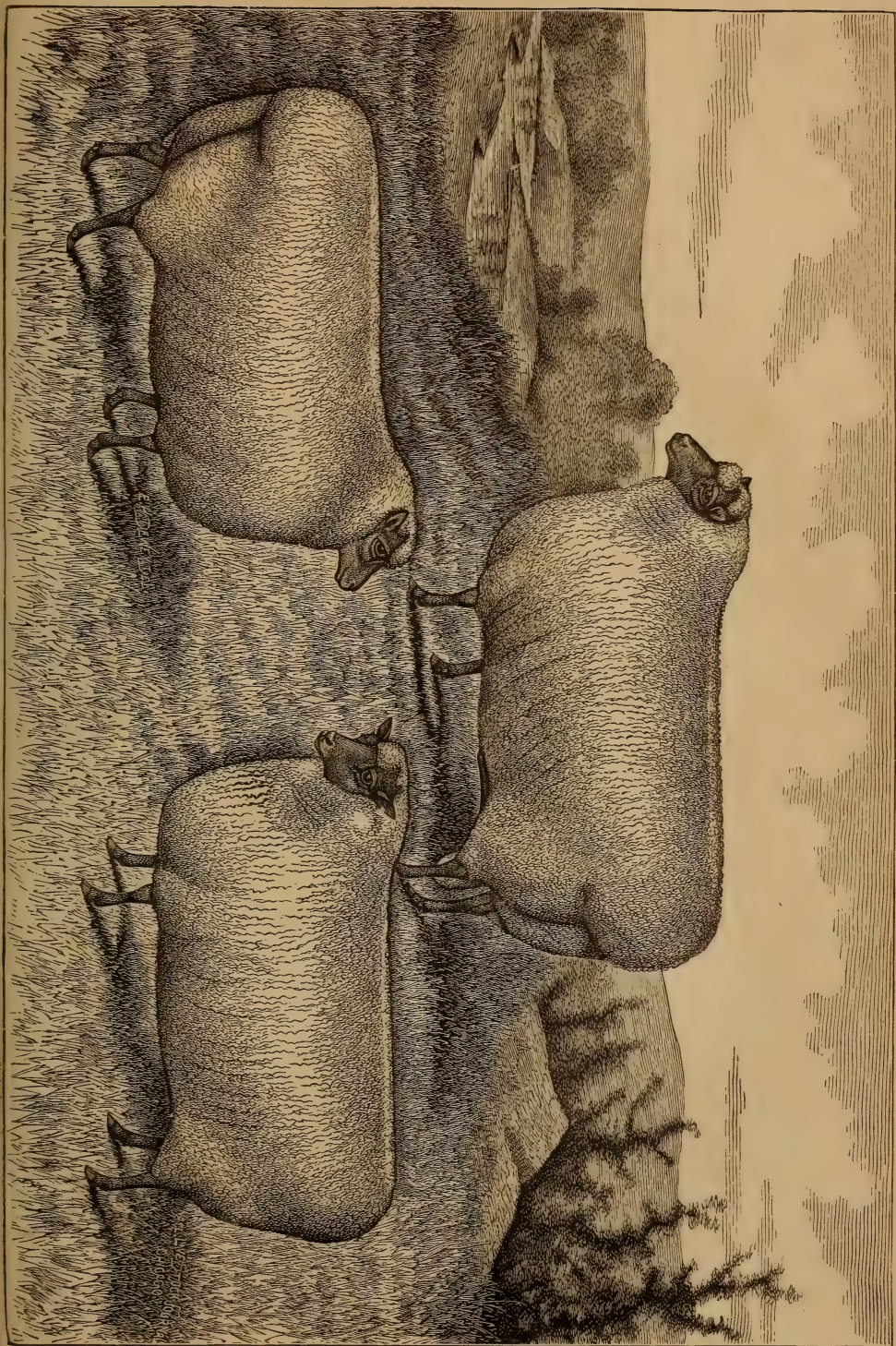
Again, sheep use the material which the farm supplies to much better advantage than cattle. It has been demonstrated that seventy-five pounds of food of any suitable kind, hay, potatoes, turnips, or meal, will make as many pounds of mutton as one hundred pounds of the same food will make of beef. Then, too, for supplying meat for the farmer's own table, sheep are very valuable and ought to be more extensively used. That mutton is a more healthful kind of meat to use in hot weather than pork there can be no doubt. Properly cooked, it is also very palatable. The farmer can furnish an abundant supply at a small cost. He can thus have some of the finest qualities of meat at a cheaper rate than he can buy the poorer grades from the butcher. There are many farmers who would find it profitable to keep sheep for this purpose.

There are many States in which sheep might well be kept in order to improve the land. There is an old SPANISH proverb which asserts that "the hoof of the sheep is golden," and many others, of various nations, which convey much the same meaning. Many of these common sayings exceed the truth. Sheep cannot, alone, convert a desert into a garden. They cannot live and thrive without food. In order to do their best they must have an abundance of food, and it must be of good quality. The idea that sheep can be turned upon a barren field, which by bad cropping has been utterly exhausted, and from this field not only obtain their living, but also get material from which to grow heavy fleeces and produce fine lambs, and by their presence convert the land into a luxuriant pasture, is wholly erroneous. If they have sufficient food from other sources, and are kept part of the time each day upon a run-down field, they will pick off the weeds and scatter their manure, thus tending to make the land better. By feeding sheep well in the winter, spreading their manure upon the exhausted field, getting clover started, and *then* keeping the sheep upon it, the land may be rapidly improved. That land of moderate fertility may be made much richer by pasturing sheep upon it we do not doubt. If there is anything to do with, sheep will utilize it to the best possible advantage. If there is nothing with which to make a beginning, neither sheep, nor any other animals, can bring it into a high state of fertility until man has done something in the way of improvement.

The farmer who keeps sheep in connection with grain and grass growing, and with other stock, can, as a general rule, obtain a large profit from them. Some of the largest crops, and succeeding these a marked improvement in the land, have been secured by the use of the manure made by sheep. HON. GEORGE GEDDES, whose opinion upon other subjects we have quoted, and who is universally recognized as an authority, in speaking of his own experience in keeping sheep in connection with grain-

growing, has said: "With about one sheep to the acre of cultivated land, pasture and meadow, we raise more bushels of grain on the average than we did when we had no sheep to manufacture our coarse forage into manure, and to enrich our pastures to prepare them for grain crops. While producing more crops on less acres, and at less cost than we did before we kept sheep, and, at the same time, constantly improving our land, we have the wool and mutton from our sheep in addition." In connection with the growth of clover, sheep can be made to bring land which is moderately fertile into good condition for producing wheat, and then keep it yielding large crops every few years and constantly increasing in value and productive capacity.

The man who is willing to feed and care for his sheep can receive from them a great deal of help in securing good crops and making his land rich. But it is not safe for any one to engage in the business unless he is willing to take care of the flock and furnish an abundance of good food. And lest any reader should infer from the remark of MR. GEDDES, that the sheep manufactured his coarse forage into manure, that he kept them exclusively upon that kind of food, we will say that neither he nor any other man who has made money from sheep ever kept them wholly on refuse food. Good hay, bright straw, and a liberal supply of meal, have been the standard food. The coarse material has either been used as bedding or else cut and sprinkled over with meal. Sheep can profitably use a large quantity of bedding, and, by using it in this manner, coarse swale hay may be made of considerable value. The manure which the sheep make in the winter is very beneficial to crops, and that made in the summer is so much more evenly spread over the ground as to enrich the pastures to a much greater degree than that which is dropped by cattle. It is owing to this difference that, while pastures upon which cows are kept gradually become impoverished, those which are devoted exclusively to sheep which are



properly managed and cared for constantly grow better. In ENGLAND this one item of improvement of the land is thought a sufficient reason for keeping sheep. Some of the ablest writers in that country have asserted that there is no profit in the production of either wool or mutton, but that, in spite of this fact, sheep husbandry is an "indispensable necessity as the sole means of keeping up the land." There are many farms, both at the SOUTH and the EAST, upon which sheep might be made profitable for this one purpose and also yield a large income as producers of meat and wool.

BREEDS OF SHEEP.—There are many different breeds of sheep, and these breeds are divided into classes which are formed by means of the difference in the length of the wool. Thus we have a fine-wooled class, the distinguishing feature of which is very fine, short wool; the BRITISH short-wooled class, comprising sheep whose wool is of only moderate length and fineness; and the long-wooled sheep, whose fleeces are very long, and the fibre rather coarse. Then there are all manner of grades and natives. Among these may be found some excellent and very profitable flocks. Also many which are not at all useful, and are very far from being ornamental.

Of the fine-wooled sheep in this country the MERINO is the "standard," and is altogether the best. It is hardy, prolific, and yields a large quantity of wool in proportion to its size and weight. The quality of the wool for many manufacturing purposes has no superior. When a Merino ram is used with a common ewe, the lamb usually has a fairly fine fleece, which is a great improvement on that of its dam. If with the lambs thus obtained a pure-bred Merino ram is used, the wool will be still better. In a few generations, the wool will be nearly, if not quite, as good as that of purely bred sheep. The finer the wool of the sheep which are crossed in this way the sooner the desired result will be accomplished.

We do not advocate this plan, except in those cases in which

pure blood cannot be obtained. The method indicated improves the common sheep, but it does not make the lambs equal to MERINOS. Even though the desired fineness of fleece may be secured, the other useful qualities of the old-established breed may be wanting. The man who has purely bred Merinos had better keep them so. All infusion of "native" blood will be a deterioration, and crossing with other improved breeds is not to be recommended. This principle also applies with equal force to the other breeds of sheep. In a flock of thorough-breds the introduction of native blood will prove an evil. Natives are only to be used when an existing flock is to be improved. We should not recommend them for the formation of new flocks. Thorough-bred sheep are now sold for prices which place them within the reach of the average farmer, and they multiply so rapidly that a flock of moderate size can soon be secured from a single pair.

Of the BRITISH short-wooled sheep the OXFORD DOWN and the SOUTH DOWN are, for this country at least, much to be preferred. Though the wool is not as fine as the MERINO, the quality of the mutton is very much superior. The lambs are larger and mature early. The sheep are fine in appearance and are quite hardy. They fatten readily, and where both wool and mutton are desired we consider them the best sheep which can be obtained. For the farmer who keeps only a small flock, they will answer all requirements. They also do as well as others in large flocks. We consider these breeds excellent for the shepherd, and as near perfection for the farmer as anything which can be devised.

Of the long-wooled breeds the COTSWOLD and the LEICESTER are the best. They are large sheep, with very long and rather coarse wool. These breeds are so near alike in external appearance that "their distinction is difficult to the unpracticed eye." The COTSWOLD, however, usually has considerable wool upon the forehead, while the LEICESTER is nearly bare-faced.

Each of these breeds is claimed by its admirers to be the best. The COTSWOLD has been much more extensively introduced into this country than its competitor, and it has been more widely advertised. It is claimed that the COTSWOLD is more hardy than the LEICESTER, and the quality of the mutton is said to be slightly superior. On the other hand, the LEICESTER matures early and fattens easily. There is also a lustre to the wool which is wanting in other breeds, and which, for some kinds of goods, makes it very desirable for manufactures. The COTSWOLD ewes are more prolific than the LEICESTER, and give more milk.

We think that, of the two, the COTSWOLD is to be preferred by the farmer who makes the sheep interest only an incidental and gives most of his attention to other departments. But neither of these breeds can be successfully kept under all the conditions to which the other classes can be safely subjected. They are kept to some extent in CANADA, but it seems to be admitted that they are not suited to the climate. They are excellent sheep for mutton in that they furnish a large quantity of meat for the food which they consume, and where mutton is a great object they may be made profitable in places where their other qualities would not justify their introduction. But the conclusion reached by JOHN L. HAYES, ESQ., SECRETARY of the NATIONAL ASSOCIATION OF WOOL MANUFACTURES, that the climate at the NORTH "is too severe for the LEICESTERS," is probably correct, and it will pay the farmers in that section to obtain a hardier breed. The place for these sheep seems to be "where the lands are rich, not subject to drought, fitted for root culture, and where good city markets are easily accessible." Nearly the same statement might be made concerning the COTSWOLDS. Where the surroundings are favorable these breeds can be made very profitable. Where the climate is too severe, or the soil too poor, other races should be kept.

Of the NATIVE breeds of sheep but little need be said. As a

rule they are far behind the breeds which have been named, and should be crossed with, or, much better, superseded by, them. The best natives may be used as the foundation for an improved flock, but the poorer ones should be sold and their places filled with a better and more profitable class of animals.

BREEDING.—In all efforts for improvement a thorough-bred ram should be used. We have indicated the superiority of thorough-bred cattle to grades for breeding purposes. The same principle holds, to the same extent, in breeding sheep. The use of a grade male will give uncertain results, but they will generally be unprofitable. The thorough-bred male will be very sure to impress his own good qualities upon his offspring. The cost of a blooded ram is so low that the farmer has no excuse on the ground of expense for using a grade. He can buy a lamb, keep him a year or two, and then sell him for as much, if not more, than he paid. But if he keeps only a small flock and counts the cost carefully, he can unite with two or three neighbors in purchasing, or hiring, a thorough-bred. One ram can serve several flocks of a dozen sheep each without injury. Even a good strong yearling can serve half a dozen ewes. It is better to use older ones, however, when practicable.

During the breeding season the ram should be kept in a pasture, or a pen and yard, with some wethers if there are any in the flock, and should have some oats or oil meal each day. The ewes should be served only once each, and when served should be marked with paint. Two rams should never be put in a pasture together, as they are almost sure to prove quarrelsome. It is well to handle them when young and teach them to be led by a halter and to be tied in a stable. But all "fooling" with them, either by boys or men, should be carefully avoided. It is a very easy matter to get a pleasant ram so that he will attack any one who comes into the enclosure in which he is kept. When a ram once gets this habit, he is very dangerous and ought to be blindfolded to such an extent that he cannot

see in front of him without holding his head high in the air. We have been knocked around a good deal by this class of animals, and feel justified in cautioning our readers to be careful to avoid either a pitched battle or an unsuspected attack.

When in a field or yard with one of these animals, always keep watch of him. If he attempts to strike, either spring suddenly to one side, or, if he is seen soon enough, swing your hat and "alrate him with a terrible voyce; and beat him yourself with a good sticke upon the head between the ears," in the manner directed by the old tamer in QUEEN ELIZABETH'S time for subduing a vicious horse. The motion of the hat and sound of the voice will sometimes confuse a ram so that he will give up an intended assault. If a battle is once begun, it should not be ended until the ram is thoroughly defeated. If he once obtains a victory, he will never forget it, but will become very cross and dangerous. No fear should be shown at any time, as this would induce an attack which might not be made if the man were self-possessed. At the same time it is necessary to keep a close and constant watch. A ram may be kept until he is seven or eight years old, provided that he is a good stock-getter and is not vicious. If his lambs are not well formed, if he is not sure, or if he becomes cross, he had better be made into mutton as soon as possible.

Although it is not so essential that the ewes should be thorough-bred as it is that the rams should be of pure blood, it is better that they should belong to an improved breed. In any case, whether natives or blooded ewes are kept, only the very best ones should be used for breeding. The first lamb should not be brought until the ewe is two years of age. If the ram is allowed to run with the flock during the year, the ewes will bring forth their young at an earlier age, but the lamb is not likely to be first-rate and the dam is seriously injured, both in development and in constitutional vigor, by this early use of the reproductive powers. Very old ewes are also to be avoided for

breeding purposes. After eight years of age nearly every ewe is unfit for further service in this direction. She may look as bright and seem as strong as ever, but the vigor and elasticity of youth are gone and cannot be restored. With generous keeping and kind treatment many, in all, will breed until ten years of age. But there is a greatly increased risk both to the ewe and the lamb, and both are often lost. The man who breeds sheep to the best advantage will keep no ewes after they are eight years old and will obtain the great majority of his lambs from those which are considerably younger.

As far as this point is concerned, the method which has been pursued by the CARLETONS, of WEST NEWFIELD, ME., is one of the best which can be named. From a letter received from MR. J. L. CARLETON, we will give a few facts concerning a small, but, in some respects, a very remarkable, flock of sheep. In 1804 a MR. CARLETON purchased the farm which has since been owned by his descendants. Of the man who had owned the farm he also bought six sheep. From these six animals those of the present flock are descended. The sheep now on hand are large frame, hardy, have nice wool, and weigh from one hundred and twenty-five to one hundred and fifty pounds each. The original sheep were supposed to belong to an "old English" breed. For seventy-three years no ram has been kept with this flock, but each year one has been secured for a few weeks. In this way many different breeds have been represented, and many kinds of "blood" have found their way into the present flock. For a long term of years fourteen sheep were kept. Every year the two oldest sheep were sold and two lambs were raised to take their places. Of late only eight sheep have been kept, but fourteen lambs have been obtained in a single year.

While we do not approve of so much mixing of different breeds we do most heartily commend the practice of selling a certain number of the old sheep, and raising an equal number of lambs each year. This is the very best way for keeping a flock

always thrifty and vigorous. The man who sells all his lambs each year because they will bring more money than the sheep will soon have a worthless flock.

Every ewe should be marked, and in a pass-book, kept for a sheep register, its age, weight of its fleeces, and number and weight of its lambs, should be recorded. Every year the oldest ones should be kept from the ram, fed with corn and roots during the fall, and sold for mutton early in the winter. The lambs which are kept should be the finest ones in the flock. The butcher will give more for these than he will for the poorer ones, but the use of inferior breeding stock is the direct road to ruin in the sheep business. Besides, the extra price which the finest lamb will command is soon made up to the farmer who keeps her. Each and every lamb which she has will sell for from one to three dollars more than could have been obtained for the lambs brought by the inferior ewes. As the sheep should have five or six lambs in the course of her life, the aggregate difference will be greatly in favor of the farmer if he keeps the best. Not only this, but if inferior ewe lambs are kept, their lambs will be still smaller and poorer, theirs, in turn, will degenerate, and soon the flock will "run out."

The lambs which are to be kept should be petted, and all the sheep should be kept quite tame. This is easily done if they are always treated kindly. A wild flock of sheep cannot be as profitable as one, otherwise in the same condition, which is tame, and the labor of caring for the wild flock will be much greater and more troublesome than that of looking after the other. Begin with the lambs when they are quite small, handle them often, and never scare them. Feed them well, and take good care of them. If these things are done, the lambs and sheep will be tame and quiet.

As the time for lambing approaches, the ewes which are the most forward should be separated from the flock, and put into a comfortable stable. From three to six may be put together.

If they have been well kept and properly mated, there will be but little liability of trouble at this time. Still careful attention should always be given, and help rendered if necessary. The long-wooled sheep are said to have much more difficulty at this time than the MERINOS. Mechanical assistance should not be rendered until it becomes evident that the labor of the ewe will be in vain. In many instances in which nature is fully successful several hours are required. The labor pains in these cases come at intervals, and between them the ewe is up, and seems to suffer no great amount of inconvenience. But if her strength fails and her efforts diminish, help should be given at once.

The natural presentation of the lamb is with the nose between the fore feet. If the feet protrude, the assistant should pull gently when the ewe makes an effort to expel the lamb. If the hind feet come first, there will usually be but little difficulty. When the head is turned back, or there is some other unnatural presentation, the lamb must be pushed back, and turned so that a better position can be secured. Only in a case of great emergency should an effort be made to obtain the lamb when the ewe is quiet. Aid must be given gently, but firmly, if required, when the ewe has her labor pains. If she is far gone when her case is discovered, and her pains have ceased, it may be best to attempt to secure the lamb without them. Such an effort may prove successful, and the ewe recover her strength, but it is not at all certain that this will be the case. In all cases when aid is to be given, the operator should oil his hand, and work quietly and gently. Old ewes are more likely to have trouble at this time than those which are younger, and the weakly ones than those which are strong and well. Consequently if there are any old or weakly ewes in the flock, they should receive extra food and care for a few weeks before the time for dropping their lambs.

CARE OF THE LAMBS.—If he gets into the world without

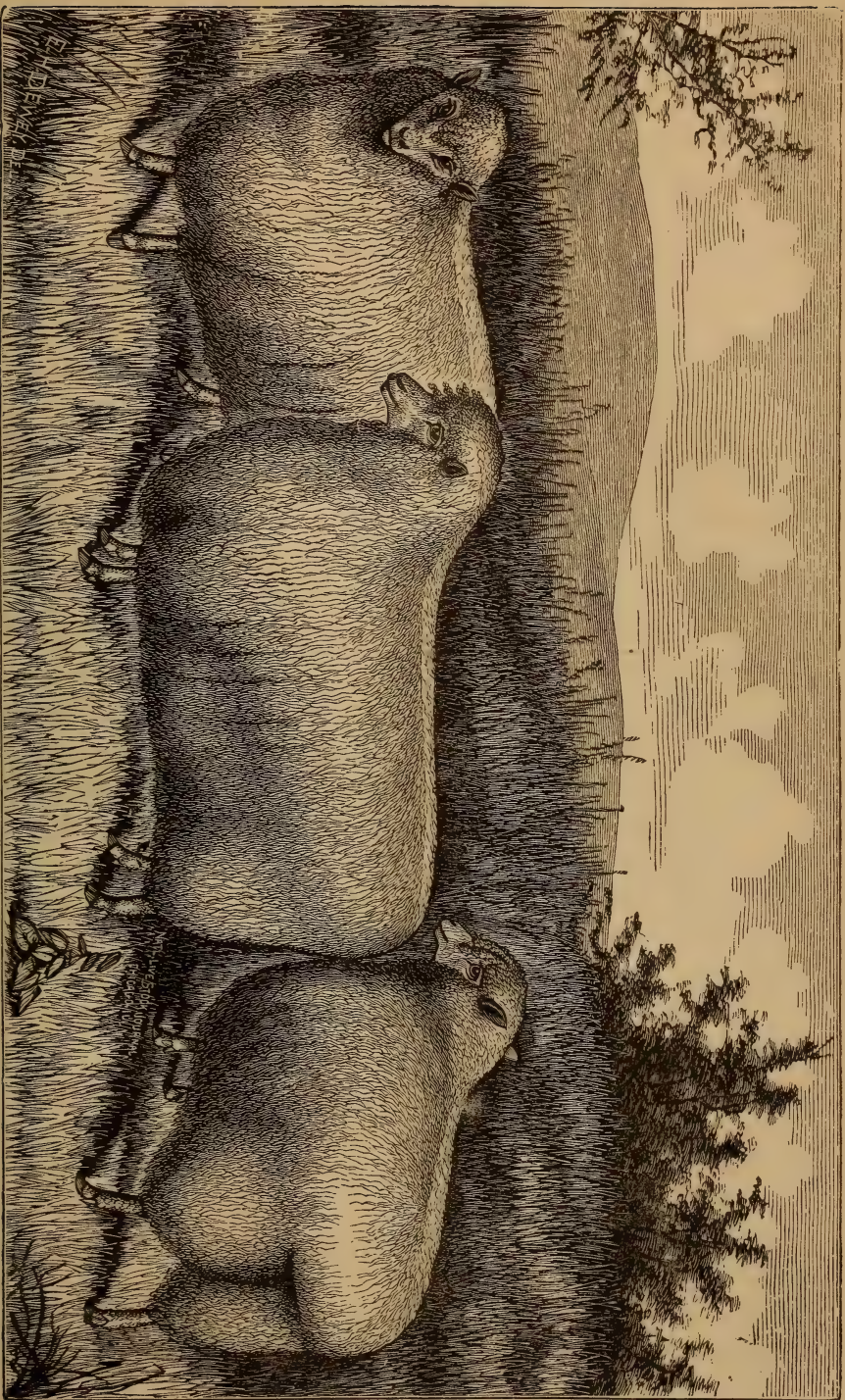


FIG. 109.—COTSWOLD EWE LAMBS, ELEVEN MONTHS OLD.
Owned by T. L. Miller, Beecher, Ill.

accident, or an unusual degree of hardship, and the ewe owns him, as she generally will, the lamb will pretty much take care of himself. The ewe will lap him dry, and he will very soon attempt to suck. It is a good plan to start the milk for him, and put him up to the teat. If he is weakly, this ought never to be neglected. If he does not incline to suck, rubbing with the fingers upon his back, and around the roots of the tail, will generally induce him to begin. A lamb is one of the most obstinate animals which man ever attempted to help. But quiet, persevering effort will in time succeed, and the worst lamb can be got sucking if he is rightly managed. In cold weather the lambs should be attended to as soon as they are able to be up. If they do not get some milk very soon they will become chilled and go beyond the reach of help.

If the ewe does not own the lamb he must be wiped dry, and the dam must be held while he obtains his food. They should then be placed together in a pen by themselves. If the pen is dark, it will be better than a light one. The ewe must be held, and the lamb allowed to suck at least six times every twenty-four hours. In many cases the ewe will in a day or two own the lamb. In others a longer time will be required. When a ewe disowns her lamb, the fact should be noted in the register, and if she does it two years in succession she should be fattened. After a lamb has been dropped, it should be cared for and made comfortable, but it does not pay to keep a ewe year after year which puts the owner to so much trouble.

If the lamb is chilled when found, he should be taken to the house, wiped dry, and put into a pretty warm oven or in water as hot as can be comfortably borne by the hand. If water is used, the lamb should remain in it only a few minutes, and when removed be rubbed quite dry with a woollen cloth. If he seems bright he may be taken to his dam and allowed to suck, but if he does not fully revive he should have a small quantity of milk from a cow which has recently calved, and in the milk from

one-half teaspoonful to a teaspoonful of whiskey, brandy, or gin. When fully restored he should be placed with his dam. If a lamb of a few days, or weeks, age is found chilly and drooping, a dose similar to that recommended above may save him without the trouble of removing him from the pen. One of the finest sheep we ever saw was so chilled when found in the morning after his birth that he could not stand. The treatment advised may not always be successful, but it is well worth trying, and will be sure to save many lambs.

Raising by hand lambs which are disowned, or which have lost their dams, involves a great deal more of work and trouble than the inexperienced reader would imagine. It can be done, and splendid sheep can be secured by the means, but it is very desirable that the ewes should look after their own lambs when possible. Some men put a disowned lamb with a ewe which has lost her own, or which has only one, and require her to look after it. When a sheep has just lost her lamb this does very well. The plan recommended when sheep disown their lambs is tried in order to make the ewe take to the stranger. Sometimes the skin of the lamb which belonged to her is laid upon the back of the new one, and the ewe is deceived into believing it to be her own. When a ewe already has a lamb it is not, as a rule, a good plan to make her support another. If the attempt is made she should receive an extra quantity of food, and this should be of the best quality.

If the lamb must be reared by hand, it should be either fed with a spoon for a while, or from a bottle having an India-rubber nipple, but should be taught to drink when only a few weeks old. The milk should be obtained from one particular cow, and one which has only recently calved. Farrow cows' milk is not suitable, and lambs are almost sure to die when fed with it. If it must be used, a little molasses and water should be added. Milk should be warm when fed, but ought never to be scalded. MR. RANDALL recommends feeding a new-born lamb six times

per day "at equal intervals between sunrise and ten o'clock at night." After a few days five times will be sufficient. Some farmers hold the lamb up by a cow and milk into its mouth. This is a dangerous practice, and often kills lambs of considerable size. In order to be at all successful in raising lambs by hand the owner must be very regular about feeding, and extremely careful in adapting the food to the wants and condition of the particular individual which he has in hand. A comfortable pen should be provided in some building near the house, and a reasonable amount of exercise should be allowed. The whole process looks simple enough, but the difficulties are much greater than they appear. Still, it is not best to allow a good healthy lamb to die without making an effort to save it. Many fine sheep have been raised in this way, and have paid well for all the time and trouble which were taken in caring for them.

DOCKING, though often wholly neglected, ought to be performed when the lamb is only a few weeks old. When lambs are designed for the butcher there is not the necessity for this course that there is when they are to be kept upon the farm. But even then the long tails often prove troublesome. As it often happens that a lamb is kept which the owner designed to sell, it is best to perform the operation. A sheep with a long tail becomes a filthy animal, and its life may be lost solely on account of the neglect of its owner to remove it.

Docking should be performed in cool, dry weather, and in the morning, before the lambs have had a chance to get their blood warm by running. A sharp knife is the usual instrument, but a broad, thin chisel is much better. If a knife is used, the edge should be placed the under side of the tail, and the cutting be upward instead of the very common method of cutting from the top downward. The tails should be left only two or three inches in length. It is much the best way to have one person hold the lamb, and another do the cutting. When a chisel is

used the tail should be laid upon a smooth block, the skin crowded toward the body, and the cutting be done by a single blow. When this plan is followed the skin slips back and partially covers and protects the cut surface. If the operation is performed in hot weather an ointment made of tar, butter, and turpentine should be applied in order to keep away the fly.

CASTRATION.—This operation should be performed in the morning, and in cool, fair weather, if possible. It should be done when the lambs are only a few weeks old, as it causes much less pain, and less trouble afterwards, than it does when they are older. MR. RANDALL describes the method to be pursued as follows: "An attendant holds the lamb (with a fore and hind leg grasped in each hand) in an upright position, with its back placed against his own body. He draws the hind legs up and apart, and presses against the lamb's body with sufficient force to cause the lower part of the belly to protrude between the thighs and the scrotum to be well exposed. The operator then cuts off about one-third of the scrotum; takes each testicle in turn between the thumb and forefinger, and, after sliding down the loose enveloping membrane to the spermatic cord, pulls out the testicle with a moderately quick, but not violently, jerking motion." We think it much better to *cut* the cord with a sharp knife. The cord should not be left long enough to protrude from the scrotum, nor cut so short as to be drawn within the abdomen. We believe, with MR. ALLEN, that the jerking process "is a severe and cruel way, and not so safe as the other." We have sometimes followed one plan and sometimes the other, and have never lost a lamb by either method, but the pulling out of the cord seems both unscientific and barbarous. It is very true that the breaking of the cord prevents bleeding, and that clamps and the hot iron are inconvenient, but, when properly performed, cutting does not cause severe bleeding, and we have never found use for either clamps or irons. If the weather is

warm, the mixture of tar, butter, and turpentine, recommended for use when docking is performed, should be applied.

FEEDING lambs must be, to some extent, dependent upon the purpose for which they are designed. Those which are to be kept upon the farm, to take the places of the older members of the flock, should run with their dams, have plenty of rowen hay, and fresh water. Those which are to be fattened for the butcher should, in addition to the above, be fed with meal. INDIAN meal answers very well, but oil meal is a great deal better. Not only is the latter a more efficient agent for accomplishing the purpose desired, but the lambs learn to eat it more readily than they do the INDIAN meal. If neither of these can be conveniently furnished, oats will be found quite useful. A small pen should be made in one corner of the sheep-yard, and so arranged that, while the lambs can enter freely, the sheep cannot get in. A trough should be placed in this pen and the lambs taught to go in. At first only a little meal should be sprinkled in the trough, but as the lambs learn to eat it, and also increase in size, the quantity may be gradually increased until, when they are three months old, they receive nearly a quart of meal each per day. Feeding with meal should be commenced when the lambs are three weeks old and continued until they are sold to the butcher.

When the lambs which are to be kept are about four months old they should be weaned. This is wholly neglected by many owners, but this neglect invariably causes bad results. The ewes are injured by being obliged to furnish milk for the large lambs, and the lambs are injured by depending upon the milk for food to the neglect of the grass which they ought to eat. At this time the dams should be put in their pen and the lambs into a stable, or other enclosure, as far as possible from the sheep. The dams should be fed with dry hay, in order to check the secretion of milk, and the lambs should have rowen and a small allowance of oats. Both sheep and lambs should be

watered twice a day. It is a good plan to keep one or two old and tame sheep with the lambs.

After two or three days the sheep may be turned into a short pasture, but they should be brought to the barn every night for a week and milked. After this they should be driven up once in two or three days for the same purpose. This should be done until the secretion of milk has ceased. Many farmers utterly neglect this precaution. They get up their sheep when they sell, or wean, the lambs, separate them, and then turn the sheep into the pasture without milking them at all. To this neglect a large part of the difficulty with sheep which do not have milk enough for their lambs, or which have inflamed udders, may be directly traced. As soon as they are dried off they should be put into a better pasture and well kept until they are brought into winter quarters.

When the lambs have been kept up two or three days they may, with the old sheep which are to be their companions, be turned into a nice pasture in which the feed is very fine and short. If no such pasture can be provided, as good one as possible should be secured, and from one-half gill to one gill of oats per day should be given to each lamb. Early in the autumn, when the pastures begin to fail, oats should be given each day until the lambs are put into winter quarters. It is very important that the lambs should not be allowed to grow poor from the time when they are weaned until the last day of their lives. The way to make money with sheep and lambs is to always keep them well, and never allow them to lose flesh. If they are thin in flesh when winter sets in they will be very liable to die either from disease or weakness before warm weather comes again.

THE SUMMER MANAGEMENT of sheep is very simple, and in addition to what has already been suggested there is but little to say upon the subject. A good pasture, in which there is an abundance of good food and plenty of pure water, should be

furnished. A shed, open at one side, should be provided for shelter from the noonday sun and from storms. In this shed a trough should be placed in which a supply of salt should be constantly kept. We have long practiced keeping sheep in the same pasture with cows, but the plan is not to be commended. If the cows are gentle, they will not often hurt the sheep; but the best of cows seem to hook sometimes, and there is constant danger that the sheep will be injured.

A ram should not be allowed to run with the ewes, but should be kept in a separate pasture, or, if unruly, at the barn. If allowed to go with the ewes, the owner will never know when to expect the lambs, and they will come stringing along from late in the winter, or early in the spring, until the sheep are turned out to grass. This makes bad work in many respects. The lambs are not ready to be sold together, but must go in many small lots, the trouble of feeding is increased, as is also the difficulty of weaning the lambs and drying off the ewes.

WASHING.—It used to be the almost universal custom to wash sheep in a brook or pond, from ten days to three weeks before they were to be sheared. Lately this practice has been growing unpopular, and we hope it will soon be entirely abandoned. When washing is practiced at the NORTH, the shearing must be put off too late, as the water in the brooks is not warm enough for the purpose as soon as the air is warm enough to admit of shearing. To drive sheep a long distance in hot weather, and, while they are heated by the exercise, plunge them into a cold stream, must be a great injury to the animals. A large quantity of water remains in the wool and reduces the temperature of the body to a very low point.

Not only is washing an injury to the health, but there is great danger that contagious diseases will be spread by its means. Many a sound flock of sheep has become affected with the foot-rot, and many more with the scab, by being driven over the

same road and shut into the washing pen which has been occupied by sheep which were diseased.

Again, the men who do the washing often contract lung diseases as the result of their exposure while working in the water. Rheumatic troubles are also either engendered or aggravated by the exposure, and various other difficulties have been known to spring therefrom.

While it involves many difficulties and some dangers, washing does not accomplish the purpose for which it was designed. It does not secure anything approaching uniformity in the condition of the wool of various flocks. Some sheep, when unwashed, have cleaner wool than some others which have been through the ceremonial. Men are not always honest in doing this work, and some have seemed to try to get as little dirt as possible from the fleece, and yet sell washed wool. Others have washed carefully and sold, at the same price per pound, wool which had been well cleaned. This is manifestly unfair. Again, MERINO sheep will have a very large proportion of dirt and grease in their wool, even after being washed in a brook, while from the SOUTH DOWN fleece nearly all of the foreign matter is removed. And as the manufacturer is obliged to clean the wool before he can use it, we see no reason why he should not be willing to take it, at a fair price, without being washed. We think such a course would be much the best for all parties, and are glad that it seems to be gaining ground so rapidly and meeting so much favor where it has been tried.

In this connection we should say that it is important to keep the sheep as clean as possible. They should not be allowed to get burs, or twigs, or other foreign matter, into their fleeces, and if any locks of wool become coated with manure, they should be clipped off, before the ewes have lambs, and thrown away. The owner should take an interest in keeping his sheep clean, and have some pride in their presenting a fine appearance.

SHEARING.—When performed by hand, this is hard work for the man and still harder for the sheep. We know of no way in which it can be made very easy for either, but care on the part of the operator would greatly reduce the suffering which the sheep usually have to endure. When a machine is used, both man and sheep are much relieved. Figure 110 represents an excellent machine for this purpose. By its use a man can easily shear ten sheep per hour, and as it cuts the fleece evenly and closely, without clipping it a second time, manufacturers consider the wool worth a cent a pound more when cut with the machine than it is when common shears are used. This machine is manufactured by C. M. MOSEMAN & BRO., of New York city.

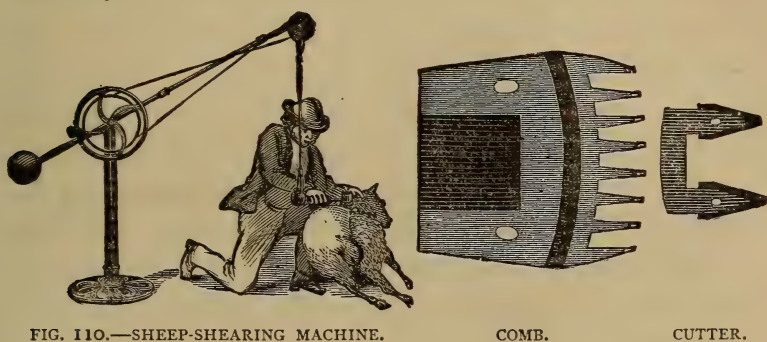


FIG. 110.—SHEEP-SHEARING MACHINE.

COMB.

CUTTER.

When performed by hand, the shearing should be done with care and skill. The men who are in a constant hurry, who cut and slash both wool and skin, ought never to be employed. A sheep that is badly cut when sheared will not recover from the effects of the injury thus inflicted during the summer, and may lose its life in consequence. It *pays* to handle the sheep carefully and to avoid cutting them. The work should be done on a smooth and clean floor, or on a platform made for the purpose. The latter we have never tried. It is highly recommended by some shearers. The sheep should be kept in the pen but a short time, as the shearing can be more easily performed, and with less trouble to the sheep, when they are well filled with grass than it can when their stomachs are empty. Before they

are taken to the floor all the dirt and straw should be got off from their feet, and any locks of wool which are covered with manure should be cut off. The sheep should be set on its rump, and the wool sheared from its neck and fore-shoulders, then laid upon one side and the upper side sheared, then turned over and the wool taken from the other side. The wool should be cut reasonably close, but care must be taken neither to cut the skin nor the teats. The shearer should be quiet and gentle, and keep the sheep in an uncomfortable position as short a time as possible. Good shears are necessary to the easy and rapid performance of this work.

While we do not favor extremely early shearing we think it very important that this work should not be delayed too long. In hot weather sheep which are covered with long wool are extremely uncomfortable, and the thick covering is very injurious. When the sheep are out in heavy rains the wool takes in a large quantity of water, and the evaporation of this moisture removes a great deal of heat from the system, thus inviting a severe attack of disease. Besides, when sheared late in the summer the wool does not get a good start before the next autumn, and the sheep is unduly exposed to the cold weather when it comes.

For some days after being sheared the sheep should be protected from storms. Many sheep have been killed outright, and a multitude more have incurred disease which finally, after much suffering, resulted in death, by exposure to a heavy rain soon after being sheared. The skin of the sheep is very loose and open, and after the wool is removed rain easily penetrates it. A heavy rain also removes much of the natural heat from the system, and causes congestion of the vital organs. The fleece is a great protection, and after its sudden removal the sheep should be well cared for until the system has power to adapt itself to the change. The newly sheared sheep should not be left out at night, during a rainy day, or a thunder-storm, but

should be shut into their barns during these times. This makes some extra work, but it pays well to take care of sheep at this critical period.

Ticks.—These parasites attack all neglected sheep, and many which are well cared for. We once bought a lamb, of a prominent breeder of sheep, which was covered with them and which distributed them to the whole flock. The ticks not only cause a vast amount of suffering, but they keep the sheep thin in flesh and lighten the fleece. After the sheep are sheared the ticks leave them and get upon the lambs. If let alone they will worry the lambs so much that they will not grow fast, and will come into winter quarters in very poor condition. As these parasites can be easily destroyed, there is no excuse for allowing them to remain upon the lambs.

Various methods are in use for exterminating the ticks. The old standard remedy for lambs infested with ticks was a decoction of tobacco. This was put into a tub, or narrow box, and the lamb immersed in the liquid. For this work two men are needed. One should hold the lamb by the fore legs with one hand while his other hand covers the mouth and nose so as to prevent the fluid entering them, while the other man holds the lamb by the hind legs. The lamb should be held in the fluid only a moment. Then it should be taken out, and all the liquid which it is possible to remove squeezed from the wool. During this process the lamb should stand in an empty tub in order to save the liquid which drips from the wool. If made too strong, or the lamb is kept in the liquid too long, the tobacco will sicken the animal, and may even cause its death. The rule is to chop into fine pieces from five to seven pounds of plug tobacco for one hundred sheep. This should be boiled in water until its strength is extracted. The liquid can be used either warm or cold.

The smoke of tobacco is also an effectual agent for destroying ticks, and if a fumigator is at hand may be used in preference to

the decoction described above. The same precautions should be observed in its use as were recommended when used for destroying lice upon cattle.

Still better than either of the above is the CRESYLIC SHEEP DIP, a kind of soap with which both cresylic and carbolic acids are compounded. This is used in much the same manner as the decoction of tobacco, but is not poisonous, and will not injure the animals or those who apply the liquid.

In two or three weeks after the sheep have been sheared nearly all of the ticks which were upon them will have gone to the lambs to feed upon their more tender flesh, and hide in their longer wool. Then the lambs should be subjected to some method of treatment which will remove the intruders, and give the lambs an opportunity to thrive, and a chance to be comfortable.

WINTER MANAGEMENT.—At the SOUTH sheep should be provided with comfortable sheds, and, in those portions where light snows fall, or the freshness of the food is destroyed by frost, hay and roots should be furnished as required. At the NORTH much more elaborate preparation must be made. Shelter and food must be provided constantly for several months, and the flock must be cared for not only daily but several times a day.

The sheep should be brought to the pens early in the season. Nothing is gained, but much will be lost, by keeping them out too long. When the grass has been frosted, the sheep should be got up to the yard, and fed once or twice a day, but should be allowed to run in an adjoining field most of the time when the weather is good, until it becomes quite cold, or the ground is covered with snow. At the very first of the feeding season the oldest and poorest of the flock should be separated from the others, and put upon higher keeping. They should have grain in abundance, and be made ready for the butcher as soon as possible. If any of the sheep are too poor to justify this course,

they should be killed and skinned without delay. This is much better than it is to keep them till spring, and then have them die of their own accord.

Too many sheep must not be kept in a single pen. The MERINO bears herding much better than the long-wooled sheep, but even this may be kept in too large flocks. It was formerly supposed that the long-wooled sheep could only be kept in flocks of from fifty to one hundred, but some CANADIAN breeders keep three hundred COTSWOLDS together without bad results. MR. COLEMAN, of KENTUCKY, a prominent sheep-breeder, says: "I have handled in flocks of one hundred and over. They will do well; but, like cattle, will do better in smaller lots. This is also true of other breeds of sheep." Probably, if they have plenty of room, good care, and abundant food, large flocks of sheep can be kept without trouble. But if the pens are small, or the food is poor, large flocks will soon become diseased, and the owner will sustain a heavy loss.

A good shed, which is comfortably warm and thoroughly ventilated, should be provided. Sheep will endure cold much better than they can impure air. Still they should not be exposed to the action of wind or rain, and the temperature of the pen should not run extremely low. Small pens, which are quite warm, should be provided for the use of sheep at lambing time, and for sheep which do not own their lambs. The feeding should always be under cover. A convenient rack, at which all the sheep can stand at once without crowding, should be placed in the middle of the shed. This rack should be arranged not only to hold hay but so that it can be easily cleaned, and so that roots or meal can be fed in it without waste.

The bottom of the shed should be kept constantly dry. Quite a quantity of straw, or swale hay, can be profitably used for bedding. If nothing of this kind is at hand, or can be spared, the pen should be cleaned every day. *It is not safe* to allow the ground upon which the sheep and lambs are kept to

become either wet or filthy. Better use the finest hay for bedding than to allow the sheep to stand on moist ground. Either course would be extravagant, but one would only waste the hay while the other would spoil the sheep. On most farms plenty of coarse hay or straw can be supplied.

Feeding should be done with great regularity. Many owners feed only twice a day—once in the morning and again towards night. Some feed again at noon. Sheep do not eat well in the dark. Consequently they should have their afternoon meal soon enough to finish it by daylight. Water should also be regularly supplied. Some writers assert that sheep do not need water in the summer, and others say that they do not require it in winter. We are convinced that they need it at all times of the year. There are sheep—we have seen a few—which eat snow in preference to drinking water, but nearly all those which we ever took care of drank water as regularly as horses and cows. Sheep seem to prefer to drink “little and often.” Consequently they should either have constant access to a trough of pure water, or else should be allowed to run for an hour or two at morning and night in a yard where plenty of water can be obtained. Shallow troughs are better than tubs. When the water is low the sheep can get it better from troughs, and there is less danger that lambs will fall in and be drowned when they are full.

The quantity of food will depend upon its quality. Nothing can be gained by short keeping. We always designed to give our sheep all the rowen hay they would eat, and when the ewes had lambs add some roots or a little meal to their rations. Some owners give good hay and straw, and one pound of turnips per day for each sheep. Others give one quart of oats with hay and straw, or, in place of the oats, a pound of corn or meal. An occasional feed of bright corn-stalks will be relished by sheep and do them good. It is not well to keep breeding ewes very fat, and it is absolutely ruinous to allow them to get

very thin in flesh. While a variety of food will be relished, and will give better results than any one kind which is continuously given, care must be taken not to overfeed at one time or underfeed at another. Such a course would injure the health and would damage the quality of the wool. Sheep which are uniformly well fed produce wool of uniform strength and size of fibre, but those which are sometimes starved and sometimes stuffed will have fleeces of very uneven fibre, and wool-buyers will be likely either to reject such fleeces altogether or else make quite a discount from the ordinary price.

Sheep which are to be fattened need more grain and less hay than those which are kept for breeding. They should be put into the winter-quarters early and fed with rowen, clover hay, or bright straw, and some kind of grain. The grain should be given in small quantities at first, and gradually increased to one pound of oil meal, or INDIAN corn, per day for each sheep. Buckwheat is sometimes used instead of meal or corn. The same weight should be given. We much prefer the oil meal to any other food for fattening sheep, and consider good rowen and bright clover very much superior to straw or to most other kinds of hay.

Salt should be kept in a box to which sheep can have access at any time. It seems to be necessary to their comfort, and we believe that it tends to keep them in good health. The cost is slight, and if it could be proved that no special benefit except the gratification of a natural appetite resulted from its use, it would still be best for the owner of the sheep to furnish all they cared to eat. But we think there is plenty of evidence that salt is a useful article of diet, and that it should be freely supplied to all domestic animals.

EXERCISE.—This is a very important matter and one which has not received the attention which it deserves. During the summer the sheep roam in pastures and travel around each day in quest of food. But in winter they are too often shut into

close pens, or stables, and for several months have nothing deserving the name of exercise. This period of unnatural confinement comes at a time when, of all others, the breeding ewes most need the benefits of regular exercise. The results of this neglect must be injurious to both the sheep and their lambs. In order to counteract this tendency to close confinement, some writers recommend placing the feeding racks at quite a distance from the pens. This would do well in fair weather and good travelling, but would be open to serious objections in stormy weather, when the snow is deep and when the ground is covered with ice. We have been in the habit of allowing the sheep to run in the cattle yards an hour or two each night. A larger yard and more time spent therein would probably be still better.

THE DISEASES OF SHEEP which are properly bred and cared for are few in number, but neglected or ill-bred flocks are liable to a great number of maladies. Here, as has already been insisted upon in the case of cattle, *prevention* is worth infinitely more than cure. We are fully satisfied, not only from observation but from an experience of many years, that there need be but little sickness in well-kept flocks of sheep. Having given directions for taking care of sheep so as to keep them well, we shall only consider a very few of the diseases to which neglected flocks are exposed. And even these diseases are sometimes better exterminated by destroying the sheep infected by them. Probably the majority of sheep-owners would do well to follow the course long since marked out by MR. PETERS, of DARIEN, N. Y. He says, in a letter to MR. RANDALL: "After years of experience I discarded all medicines except those to cure hoof-rot and scab; and I finally cured those diseases cheapest by selling the sheep. An ounce of prevention is worth a pound of cure. If sheep are well kept summer and winter, not overcrowded in pastures, and kept under dry and well-ventilated covers in winter, and housed when the cold fall rains come on,

there will be no necessity for remedies of any kind. If not so handled, all the remedies in the world won't help them, and the sooner a careless, shiftless man loses his sheep the better. They are out of their misery and are not spreading contagious diseases among the neighboring flocks." Unless the animals are particularly valuable, it will pay better to check the progress of disease which assumes an aggravated form by killing the sheep than it will to attempt a cure.

CATARRH.—This disease is more likely to affect the long-wooled breeds of sheep than it is any others. It is usually caused by some undue exposure to storms—by getting chilled after running, or by lying on wet ground. It is not often immediately fatal, but sometimes weakens the vital forces so that the sheep cannot go through the winter. Prevention is easy. Cure, except by good nursing, constant care, and extra food, is very difficult, and even these means are not always successful.

COLIC is a very painful and violent disease. It is brought on by improper feeding, drinking cold water when heated, and similar causes. Confinement to dry food for a long time causes constipation which frequently results in an attack of colic. Unless relief is soon obtained this disease is likely to prove fatal.

When a sheep is attacked with this disease it has, at intervals, paroxysms of severe pain, stretches itself, twists its head around, and gets up and lies down quite often. Give, as soon as possible, one ounce epsom salts dissolved in warm water, with a drachm of ginger and a teaspoonful of the essence of peppermint. Half of this quantity is sufficient for a lamb. In mild cases, warm thoroughwort tea, made very strong, may prove effectual.

DIARRHŒA.—This disease is frequently caused by a sudden change of food from dry hay to grass. Sometimes it is brought on by a general disarrangement of the digestive functions. With sheep, the best remedy is a change of food. Lambs need more thorough treatment, and the disease often proves fatal even when

remedial measures are taken. It is usually caused, in lambs, by taking cold or by acidity of the stomach which leads to indigestion. MR. RANDALL recommends giving one-fourth of an ounce of prepared chalk in half a pint of tepid milk, once a day for two or three days, or until the disease has abated. In very severe cases, when mucus is voided with the dung, the first treatment should be the administration of a half-drachm of rhubarb, or a half-ounce of epsom salts. This should be followed by the chalk as directed above.

GARGET.—This disease is not as common among sheep as it is with cows, but sometimes proves very injurious. As soon as the udder presents an inflamed and swollen appearance, or seems to be sore, hot water in which a little opium, or laudanum, has been steeped should be applied. This wash should be repeated many times a day until a cure is effected. Treatment of this disease should be prompt, not only in order to cure the sheep, but also to save the lamb, which, unless fed by hand or put upon another ewe, may not be able to obtain milk enough to keep it alive. If this treatment, closely followed for two or three days, gives no relief, a liniment of iodine and ammonia in equal parts should be tried. But, if taken in season, the hot water and opium will almost always effect a cure.

GRUB IN THE HEAD.—This name is made to do duty for various diseases the causes and action of which are unknown. Still there are some genuine cases, and they sometimes prove fatal. A fly lays its eggs in the nostrils of the sheep, and the eggs hatch into grubs which take up their abode in the head. In order to prevent their attacks it is well to plow a few furrows, in several different places, in the pasture about the first of July. The sheep will put their noses into the fresh earth and thus keep the fly away. Some owners cover the noses of the sheep with tar. Others put tar in the salt box, sprinkle on a little salt, and let the sheep make their own application.

It is said that the grubs can be destroyed by blowing tobacco

smoke up the nostrils of the affected sheep. The bowl of the pipe is covered with a cloth and the smoke forced through the stem.

HOOF-ROT.—This is the worst of all the diseases with which sheep are affected. It is very contagious, and a single sheep suffering from this disease is capable of ruining the whole flock to which it belongs. The disease is not incurable, but prompt and stringent measures alone will suffice for its extermination. If a cure is attempted all the sheep which show any signs of the disease should be wholly separated from the others and medical treatment commenced at once. But, if the sheep are not specially valuable, we should prefer to sell the whole flock to the butcher for what they would bring, the sick ones being of no value except for their pelts, thoroughly disinfect the pens and yards, and, after the lapse of six months or a year, obtain a new stock.

If a cure is attempted, the sheep should be driven to the pens immediately after a rain, if possible, as the hoofs will then be softer than they will in dry weather. The feet must be cleaned and the operator, with sharp knives, must cut away the horn which covers the diseased portions of the foot. No more cutting than is necessary should be done, but what is needed must be thoroughly performed, as the success of the effort to cure depends entirely upon the exposure of *all* of the affected parts. For this work a careful, skilful, and if possible an experienced, operator should be secured. The best remedies will be useless if the foot is not properly prepared. When this has been effected the application of suitable caustics will effect a cure. MR. RANDALL cured many cases by paring the feet and applying a solution of blue vitriol. He obtained about twelve pounds of the vitriol for one hundred sheep. This was dissolved in a quantity of hot water and placed in a washing tub large enough to hold two sheep. The liquid was as hot as could be endured for a moment by the hand, and was kept at this heat by frequent addi-

tions of the hot solution. "As soon as a sheep's feet were pared it was placed in the tub and held there by the neck by an assistant. A second one was prepared and placed beside it. When the third one was ready, the first was taken out, and so on. Two sheep were thus constantly in the tub, and each remained in it about ten minutes. The cure was perfect." Doubtless this is a much more efficient, and, on the whole, a more merciful method than the frequent application of caustic to the feet, but it seems cruel to make a sheep whose feet are terribly diseased, and have been pared down to the quick, stand for ten minutes in a strong, hot solution of blue vitriol. Still, the common method of washing the feet with some caustic solution is slow in its effects and often proves unavailing. The caustic does not touch all of the diseased parts, and, by contact with the ground, is almost immediately removed from the spots to which it is applied. This necessitates frequent painful applications and involves great uncertainty as to the results. On the whole, if the sheep are to be saved, MR. RANDALL'S method is the best one which has yet been presented.

This terrible disease is much more prevalent among MERINO sheep than it is with long-wooled breeds, and is also much more difficult to cure. This is due, in part at least, to a difference in the formation of the foot. Whenever the disease appears it should be eradicated at once, and a great deal of care should be taken not to expose neighboring flocks. Feeding in the same pasture, or driving over the same road with or soon after an infected flock has passed, is almost sure to fasten the disease upon a large part of the animals thus exposed. Consequently in purchasing sheep care should be taken to obtain those which have no trace of this disease, and no exposure to it, however slight, should be permitted whenever it can possibly be avoided.

POISON.—Sheep and lambs are sometimes poisoned by eating laurel, both the narrow-leaved or "low laurel," and the broad-leaved or "spoonwood." St. John's Wort is also said to poison

sheep severely. Soot which has been applied to grass or grain as a fertilizer is sometimes eaten in sufficient quantities to destroy the life of the sheep. Laurel is the most common poison which sheep are inclined to eat. MR. MORRELL, in his work on Sheep, says: "After eating it the animal appears to be dull and stupid, swells a little, and is constantly gulping a greenish fluid which it swallows down; a part of it will trickle out of its mouth and discolor its lips." He says that if in the early stages the greenish fluid is suffered to escape the sheep will probably recover. To effect the escape of the fluid he recommends the use of a gag made of a stick "the size of your wrist, and six inches long—place it in the animal's mouth—tie a string to one end of it, pass it over the head and down to the other end, and there make it fast. The fluid will then run from the mouth as fast as thrown up from the stomach. In addition to this, give roasted onions and sweetened milk freely." We have never tried this method, but have relied upon the use of cathartics. The great difficulty with these is that they act so slowly that the poison gets distributed throughout the system. It is said that a strong decoction of white ash, made by boiling the bruised twigs in water for an hour, and given in quantities of from one-half gill to one gill, and repeated if necessary, will cure poisoning by laurel if administered within a day of the time the laurel was eaten. Sweet oil in six ounce doses, or one-half pint of linseed oil, will sometimes effect a cure. The immediate use of a stomach pump by means of which the poison can be diluted with water, and much of it removed, will be altogether the best method in all cases in which it is available. When this cannot be employed one of the remedies named above should be tried.

SCAB.—This is a disease of the skin, similar to the itch in men, which causes an immense amount of pain, and, if allowed to run its course, kills the sheep. It is caused by a minute insect which burrows under the skin, hatches its young, and the

new generations come out only to burrow in fresh places to bring forth their families. The affected sheep rubs against posts and doors, bites itself, and tears out its wool. Small red spots appear on the skin. These soon become sores and are covered with scabs. All infected sheep should be separated from the others, and the posts and all other places against which they have rubbed should be washed with strong tobacco water.

If the wool is short the scabs should be rubbed from the infected sheep with a stiff shoe-brush, and the animals then dipped in tobacco water as directed for killing ticks, or what is a great deal better, the CRESYLIC SHEEP DIP should be used. If the wool is very long it should be parted, and the latter remedy applied to all the sores. Short-wooled sheep are not as likely to be attacked by this disease as the long-wooled breeds, and healthy sheep are much freer from it than those which are weak and poor.

SORE EYES should be washed quite often with warm water. If this does not give relief, a very little sulphate of zinc and a small quantity of laudanum should be added to the water. All irritating remedies should be carefully avoided.

SORE LIPS.—The lips of sheep sometimes become so sore and swollen in the winter that they are very painful, and render the eating of dry hay difficult if not impossible. In such cases an ointment composed of tar, made thin by the addition of butter, and a small quantity of sulphur, should be applied twice a day until a marked improvement takes place. It should then be used occasionally until the cure is complete.

DOGS.—Among the worst enemies of the sheep-owner are the miserable, worthless curs which abound in almost every community. In MASSACHUSETTS, and we think in a few other States, there is a "dog law" which imposes a tax upon all dogs, and from the fund thus collected the owners of sheep which have been killed by dogs are paid for the animals which have been destroyed. Such a law ought to be in force in every

State, and it should be much more stringent than it is in MASSACHUSETTS. The money received never pays for the injury sustained. When sheep are chased by dogs the whole flock is demoralized, and those which are not killed or wounded are injured for life. Owners of sheep should insist upon having a law which will protect their interests. It is right that such a law should be passed and enforced.

Until the owners of dogs are obliged to keep them from destroying their neighbors' flocks, sheep-owners must protect themselves as well as possible. We have been in the habit of driving the sheep to the barn every night during the summer. This injures the sheep and makes considerable extra work, but it seems to be a necessity. Some owners say that a good-sized bell fastened around the neck of one sheep in every ten of the flock will keep dogs from chasing them. Others say that it is not a sure preventive. If nothing better is at hand, this method should be tried by all who cannot yard their sheep every night.

SHEEP ON THE PRAIRIES often prove a source of very large profits. The cost of keeping is small, and good food is easily obtained. During the summer the sheep feed on the rich and abundant prairie grass. Turnips, which yield immensely on the rich soil, furnish green food in the autumn at a merely nominal cost, and INDIAN corn almost wholly takes the place of hay for winter use.

Of course the business is done at a great disadvantage, and the losses of sheep and lambs are very heavy. The sheds which are put up for winter do not furnish adequate protection, a large variety of food cannot well be provided, and the lambs cannot have the care which is usually bestowed where small flocks are kept. But the expenses of keeping are so light that, in spite of all the drawbacks, sheep husbandry on the prairies is a recognized source of wealth.

That sheep should be more generally kept throughout the

country, and especially at the SOUTH, we firmly believe. Kept in small numbers, in connection with grain-growing and other lines of farm business, they can be made to yield very large returns. The labor of caring for them is much less than that required where cows are kept. This is an item for the farmer to consider, not only on his own account, but also for the sake of his wife. The difference in the work of the women where cows and sheep are kept is very great. We do not assert, as an old ENGLISH writer once did, that "sheep is the most profitablest cattle that a man can have," but we do believe that keeping sheep in small flocks, which are carefully managed, will make larger returns for the amount of capital and labor than almost any other department of farm business.

SWINE.

WINE are among the most valuable of our domestic animals. They fill a place which no other animal can occupy, and supply a positive demand of our domestic economy. They utilize a great deal of what otherwise would be waste material, they furnish a vast amount of food, and, by concentrating its value, they enable the farmer who is so far from the cities and towns that he cannot afford to pay the transportation charges of bulky material to get his grass and grain to a profitable market. They can be kept on large or small farms, in droves or singly, as the sole representatives of live-stock on the farm, with the exception of animals kept for their labor, or in connection with cows and sheep. They save so much material which but for them would be lost, and furnish so large quantities of valuable manure, that it is difficult to see how any farmer, even the one who does the smallest business, can afford to be without one or more of these animals.

That there exists a prejudice against swine is very true, and many people will neither keep nor eat the flesh of one of these

creatures. But the facts that the number of these animals in this country is about twenty-six millions, with a total value of one hundred and seventy-five millions of dollars, and that both number and value are constantly and rapidly increasing, indicate that the antagonistic feeling is neither very general nor very powerful. It is too late in the day to assert that pork is "not fit to eat." Nearly all civilized races make a large use of the flesh and products of the hog, and have done so for a long period. Invalids and persons engaged in sedentary employments may not be able to eat large quantities of pork without injury, but, when properly cooked, the flesh of a well-fattened pig may be used with beneficial effects by the great majority of people who are in a fair state of health. Too much fried salt pork in hot weather is not well for any one to use, but this is no reason why pork should be wholly condemned.

Neither do we regard the fact that the MOSAIC legislation excluded pork from the diet of the ancient JEWS as an indication that the improved pigs of the present day are unfit for food. There were various reasons which influenced that legislation which do not apply to our people and our conditions of life and society. The JEWS were to be "a peculiar people," and to be kept separate from the surrounding nations. Much of the legislation of the early period of their national history had for its end and aim the strict keeping of this separation. It has also been suggested that the swine in ancient EGYPT and vicinity were badly diseased, and that the use of their flesh caused, or aggravated, the leprosy from which the people severely suffered. Whatever the reason, we think that it long since passed away and that all CHRISTIAN people are at perfect liberty to eat pork if they desire to do so. And it is a noticeable fact that many who insist that the MOSAIC prohibition was a sure indication that the flesh of swine is unwholesome, do not have the same regard for the other prohibitions of that legislation, but utterly ignore many of its most stringent provisions.

BREEDS OF SWINE.—Quite a number of different breeds are now very popular in various parts of the country, and there are several which have a general instead of a local reputation. Among those which, on account of their wide dissemination as well as their valuable qualities, have become generally known, the CHESTER WHITE, SUFFOLK, and YORKSHIRE, among the white pigs, the MAGIE, or POLAND-CHINA, white and black, and the ESSEX, and BERKSHIRE, which are black, are the most prominent. There are breeds which may, when more widely known, rank higher than some of those named above. Each of the breeds we have named has excellent points. Some are better fitted to endure the exposure to which pigs kept in large droves are frequently subjected than others, which, when carefully tended, are equally good. There are multitudes of good hogs which do not belong to either of the well-known breeds, but are called “natives.” Probably a still larger number of the native pigs are extremely poor and are unprofitable animals to keep. In order to obtain a fair profit, good pigs, of some kind, must be secured. The farmer who kept the same hog seven years because he was able to “eat all the swill made on the farm,” had a very imperfect idea of the end for which this class of animals should be kept. What is wanted is a pig which will make the largest possible returns for the food which the owner is able to supply. The man who has rich clover fields and thousands of bushels of “ten-cent” corn, and who ships his pigs to the city market, wants a very different style of an animal from the mechanic in a country village who only keeps one pig to utilize the waste of the household and furnish part of the meat for family use. Thus it will be readily seen that all good breeds, however different their characteristics, have their uses, and may be made not only available but also profitable. The only caution necessary is that the right men get the right breed of pigs.

Without giving a lengthy description of each breed, we will

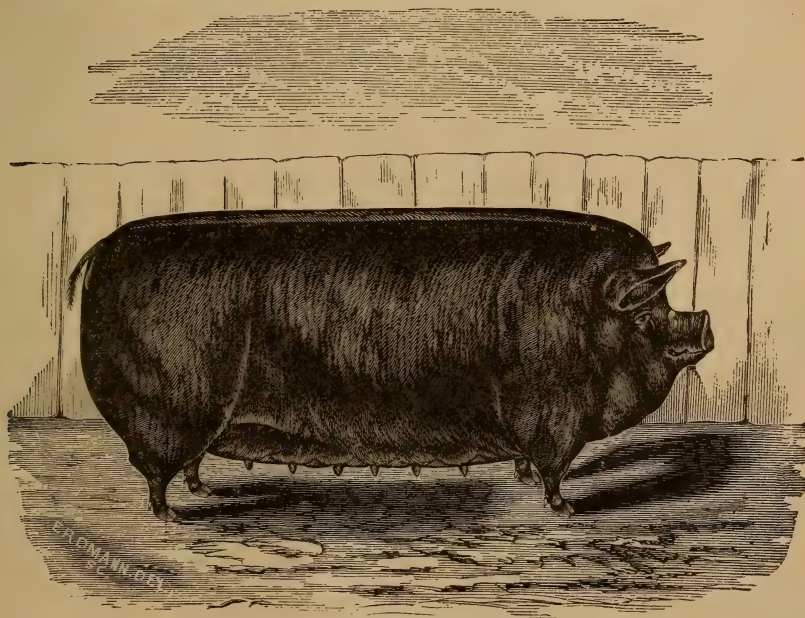
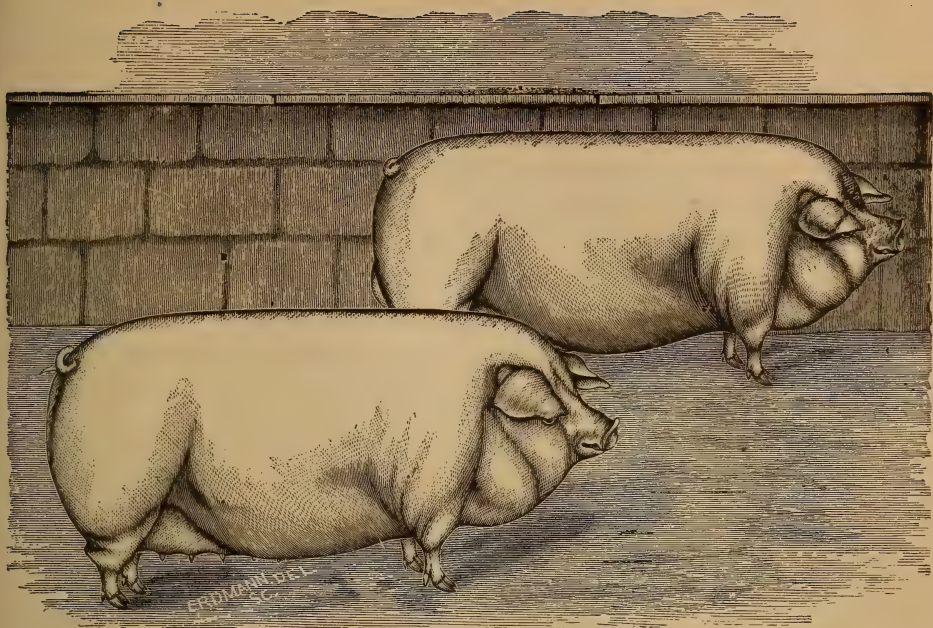


FIG. III.

1. CHESTER WHITES PIGS. "King of Chester County," and "Model of Perfection." Drawn from life.
Owned by Benson, Maule & Co., Philadelphia, Pa. 2. ESSEX PIG.

briefly mention a few of the leading characteristics of the ones which have been named. The CHESTER WHITE is a "made-up" breed which originated in CHESTER COUNTY, PA., and of which there are many different strains. The better class of pigs known by this name are entitled to a very high rank, but the popularity of the breed has been greatly clouded by the action of unprincipled parties who have sent out large numbers of the common pigs of that section (which were no better than the same class of pigs in other localities) as the genuine CHESTER WHITE, and taken high prices for them. The better classes of the genuine breed have been well established and will breed true, but many of the pigs sold under this name have not the slightest claim to a place with this, or any other specified, family. The real CHESTER is white, has a short head, thin ears, short and thick neck, long and deep body with a broad back, hams full and deep, coating thin, no bristles, and a small tail. The hogs can be made to attain a great weight. MR. HARRIS, in his work on the PIG, says that this is "a large, rather coarse, hardy breed, of good constitution, and well adapted to the system of management ordinarily adopted by the majority of our farmers."

The SUFFOLK is a small but valuable breed. Its handsome appearance commends it to those who care for the looks of a pig, while the ease with which it can be fattened and the shortness of the time required to get it into condition make it a favorite with villagers and with farmers who keep but a few pigs and who are not particular about large size. It is a very old and firmly established breed. Consequently the boars are excellent for using with good native sows.

When fed high, the pigs fatten at a very early age, and can be got into condition to kill at any time after they are six weeks old. If kept on short rations during the first few months they grow to considerable size, and can be made to weigh four hundred pounds. If given enough to eat they will stay at home,

and do nothing but eat and rest. They do well when kept on grass, and require less grain than most other breeds. As they are very quiet, they are not as useful for working over manure piles as some other pigs, but for making a large quantity of pork which contains but little waste from the smallest possible quantity of food they have no superior. Some advocates of this breed claim that the SUFFOLK pig contains as much meat that is eatable "as most hogs of double his weight, and which consume four times his food." This is, probably, an overstatement of the case, but from our limited experience with these pigs we judge that they utilize their food to the best advantage, while it must be clear to every observer that the proportion of offal is extremely small.

It is said that the SUFFOLK pigs, on account of their thin hair and tender skin, do not endure the exposure to which WESTERN pigs are usually subjected as well as some other breeds. Also, that, on account of their strong tendency to fatten, the sows are not as prolific as it is desirable they should be. Still this breed is rapidly growing in favor throughout the country, and it possesses merit enough to enable it to hold a high position among the very best breeds in the world.

YORKSHIRE.—There are a multitude of pigs scattered throughout the country which are said to belong to this breed. They vary as much in everything except color, which is always white, as they do from other white breeds. There are "large," and "middle," and "small" YORKSHIRES, and it is even claimed "that all the best white pigs of modern times" are indebted to YORKSHIRE blood for their excellencies. Several breeds which have a local reputation claim descent from the YORKSHIRE, and some declare the SUFFOLK to be only a modification of this breed. That many excellent pigs are called by this name there can be no doubt, but a title which covers large hogs and small pigs of various forms and different habits must be pretty elastic, and the application of the same name to animals which differ so

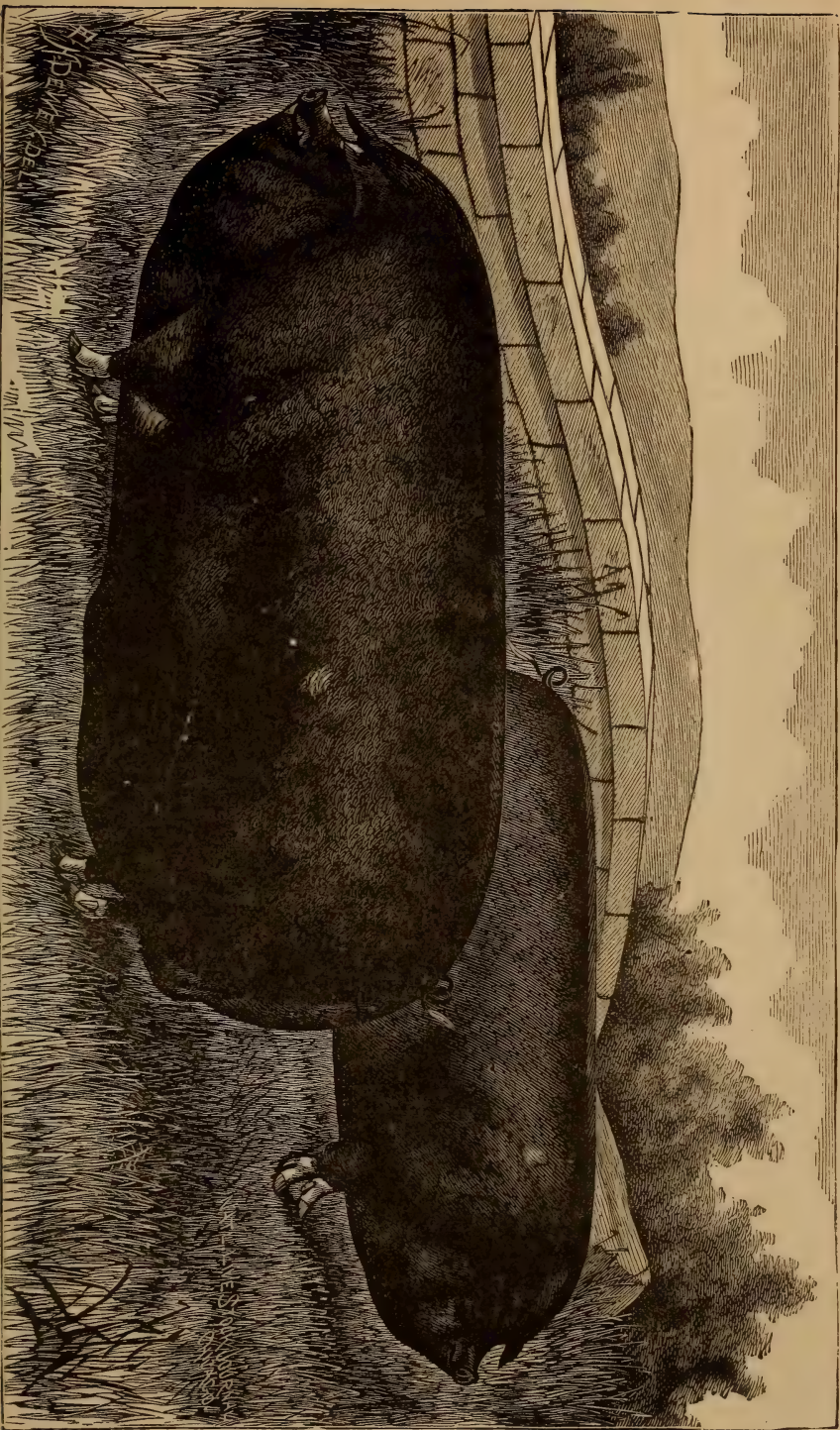


FIG. 112.—MAGIE OR POLAND CHINA SWINE—WORLD-BEATER AND PEARLESS.
Property of D. M. Magie Co., Oxford, Ohio.

widely makes it very easy for those who are so disposed to sell white pigs of unknown origin as genuine YORKSHIRES.

MAGIE, OR POLAND-CHINA.—Although this is a comparatively new breed of pigs, the originators claim that they have got it so well established that the animals breed perfectly true, and that this breed “is unsurpassed.” There has been a great deal of dispute concerning the origin of this breed, and who should have credit therefor. But it seems to have been proved beyond a doubt that its perfection, if not its origin, is due to the careful and persevering labors of D. M. MAGIE, and several other breeders in OHIO. After hearing the claims of various parties, the NATIONAL CONVENTION of swine-breeders decided that the name of this breed ought to be POLAND-CHINA, and that the dozen or fifteen other names which had been used should be dropped.

The pigs of this breed are spotted black and white, are quite hardy, good feeders, fatten well, and under favorable circumstances attain a large size. They are not as fine, and do not mature as quickly as some other breeds, but seem to be well adapted to supply the wants of WESTERN farmers. The sows of this breed when bred to BERKSHIRE boars bring forth finer pigs, which are said to mature early and fatten easily.

ESSEX.—This is a small breed of pure black swine. It has not been extensively introduced into the great pork-growing sections, but has won considerable favor in the EASTERN and MIDDLE States. With the exception of color and less trouble with skin diseases, this breed closely resembles the SUFFOLK. The pigs mature early, and fatten very easily either on grass or grain. The sows are not as prolific, and the pigs, when small, are not as hardy as those of larger and coarser breeds. They are generally considered too small to be profitably grown for packing, but they answer very well for farmers who keep but few hogs, and villagers who grow pork only for their own use. The boars are extremely valuable for crossing on sows of larger and coarser breeds.

BERKSHIRE.—Probably this is much the most popular breed of swine in this country, and there can be no doubt that it is one of the most profitable. It is an old ENGLISH breed, and, having been carefully managed for a long period, its characteristics are firmly established. These pigs are black, with white markings on the face and legs. They are very healthy and vigorous, fatten easily, and attain a medium size. The sows are prolific and are good milkers, in these respects being much superior to several of the other breeds, and the boars transmit their own good qualities when crossed with natives or with other breeds. The flesh of the BERKSHIRE pigs is said to be superior, and, on this account, this breed would seem to be well adapted to the wants of those who grow pork for home use.

While the breeds which we have named possess many excellencies, and there are several others which are of considerable value, there are many pigs which have no recognized name which can be made profitable on the farm. It is not desirable that all the men who keep pigs should keep thorough-breds exclusively. Raising thorough-breds for the butcher would hardly pay, because these pigs need more care and better food than the average farmer gives. Also, in the case of the small and refined breeds, and, to some extent, the larger ones, because a cross of a thorough-bred boar with a *good*, large, and thrifty sow will be likely to give stronger pigs, which will possess the good qualities of the boar strengthened with the vigor of the sow, than would be obtained by the use of a purely bred sow. If the best of care could, and would, be given, thorough-bred pigs would be the best. But, as MR. HARRIS has well remarked, "The aim of a good breeder of pigs is to get a breed that will grow rapidly and mature early. And the better the breed the more rapidly they will grow. But the best stove in the world cannot give out heat without a supply of fuel; neither can the best bred pig in the world grow rapidly without food; and the more thoroughly the power to grow rapidly has become estab-

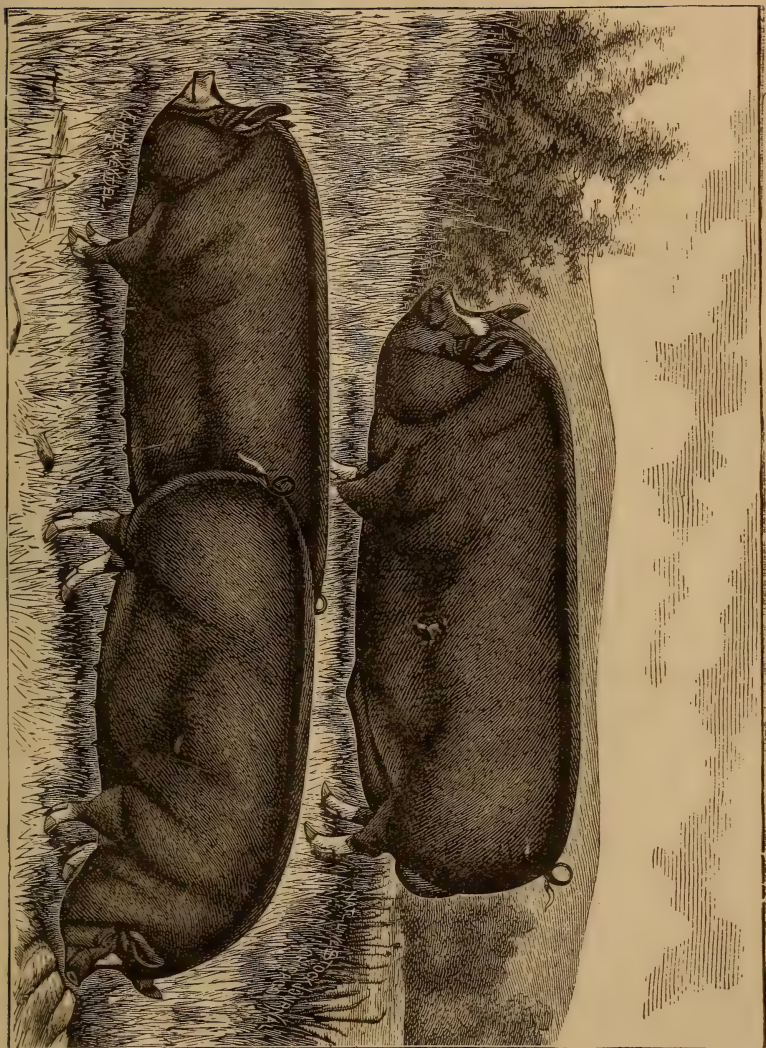


FIG. 113.

BERKSHIRE PIGS. Property of T. L. Miller, Beecher, Ill.

lished by long and careful breeding the less capable does the pig become to stand starvation."

It is only natural that the offspring of pigs brought up under adverse circumstances should be more hardy than that of pigs which have been very carefully bred. Besides, it is not necessary, in order that the desired end may be attained, to use thorough-bred sows. The writer just quoted says of the highly refined ENGLISH breeds: "Their real value consists in their perfection of form, smallness of bone and offal, and the great development of the ham, shoulder, cheeks, and other valuable parts; and added to this is their ability to transmit these qualities to their offspring. This ability is in proportion to their purity, and hence the value of pedigree. When one of these pure-bred boars is put to a good grade or common sow we get precisely what we want—pigs having the form, the refinement, the early maturity, smallness of offal, and tendency to fatten of the thorough-bred, combined with the vigor, constitution, appetite, and great digestive powers of the larger and coarser sow. In other words, as far as the production of pork is concerned, we get a perfect pig—and there the improvement ends. We have attained our object, and all that we have to do is to repeat the process." Here the case is plainly stated and a great deal of truth condensed into a few sentences. Get good grade or common sows and use only *thorough-bred* boars. This is a safe rule for farmers, and all who feed pigs for the butcher, to follow so far as this kind of stock is concerned. Of course, if this plan is to be followed, some one must raise thorough-bred pigs in order to obtain the boars which will be needed. The farmer who keeps a large stock of hogs can profitably do this himself. He can keep a few thorough-breds for this special purpose. Those who keep but few pigs can buy boars of breeders as they are needed.

As already indicated, this course is of much more importance when the small breeds are kept than it is with the larger ones.

But even with the CHESTER WHITE, POLAND-CHINA, and BERKSHIRE, grades obtained in the manner described will often be found superior, as far as the mere production of pork is concerned, to the thorough-breds. But it is all important to the success of this plan that the *sows should be good animals and well adapted to the purpose designed*. The "razor-back" and "race-horse" styles must be let alone, and the best specimens of good animals should be selected.

Whatever the sow may be, by all means *use a thorough-bred boar*. A grade hog may look just as well, perhaps even better, but he is wholly unfit for breeding purposes. The qualities of the thorough-bred have been fixed by a long course of careful breeding, and he has power to impress them upon his offspring, but the good qualities of the grade have no element of permanence, and nothing but disappointment to the owner and degeneracy to the stock can come of his use as a breeder.

Not only should the boar be purely bred, but he should be a good representative of the breed to which he belongs. There is a great difference in thorough-breds, and only the finest should be used for breeding. Some men who sell pigs weed out their stock and send the specimens which are not up to a fair standard of excellence directly to the butcher. This course should be pursued by all who deal in breeding stock.

Not only should good stock, both male and female, be selected for breeding, but the individuals should be allowed to attain a suitable age before they are used for this purpose. Here is where the majority of farmers make a great mistake. They do not wait until the pigs are fully developed, but allow them to breed before they are grown. Too many farmers allow a boar pig only a few months old to serve a sow of the same litter, or one still younger, then castrate the boar and fatten him, and, when the pigs are weaned, fatten the sow. By so doing they cannot secure the best class of pigs. From half-grown parents only a second or third class of animals can be secured. Even

under the most favorable circumstances, and when everything turns out as well as the owner expects, there is always an indirect loss. Pigs from stronger and older parents would, with the same care and food, have produced a larger quantity of pork than those from parents of undeveloped powers. But it often happens that the sow does not prove a good mother, that the pigs are feeble, and from these and various other causes the effort to secure a good litter of pigs proves a failure. If the boar had been kept until he was a year old before being put to service at all, and allowed to serve but few sows until he was a year and a half old, his pigs would have been much more vigorous and would have taken on flesh with much greater rapidity. If, in addition to this, the sow had been kept until a year and a half old before bringing her first litter there would have been a still greater gain in the vigor and feeding qualities of the offspring. Of the two it seems more important that the sow should be well developed than the boar.

While growing, it is all that the sow ought to do to perfect herself. If, in addition to this, she is obliged to give much of her strength and vital power to the production of the young, her growth will be checked, her maturity retarded, and she will be unable to impart to her offspring good constitutions, or a strong tendency to make a rapid growth. Weakness is always attendant upon immaturity, and weakness on the part of the parents is sure to involve a still greater degree of weakness on the part of their offspring.

A boar may be kept for breeding until he is five or six years old, if he is not cross and he gets good stock. If his pigs from good sows do not thrive, if he is not a sure getter, if he does not get pigs uniformly like himself, or if he becomes cross, he should be castrated. But a good boar which is properly kept will get much stronger and better pigs after he is two years old than he will before, and, as a general rule, an old boar will get better pigs than one that is young.

Where farmers keep only from two to a dozen hogs, the cost of keeping a boar on each farm is quite an item. Here the principle of neighborhood ownership, which has already been explained and advocated, should be applied. MR. COBURN, in his excellent work on "SWINE HUSBANDRY," advocates this plan, and says: "Among the benefits resulting from this method would be the use of a good boar, matured and fitted for good service; an improved class of pigs, and a generous rivalry, encouraging each of his owners to keep a better grade of sows, under improved and more profitable conditions." When several farmers own a boar in company, they can afford to keep him until he is too old to be serviceable. The cost to each one will be very slight, yet each one will have the advantage of taking his sows to a first-class and fully matured boar, and will find the extra value of the pigs in a single season more than pay the whole expense in which he is involved.

The sows which prove good mothers should be kept for several years. This is a much better way than the course often followed of fattening a sow as soon as possible after the pigs are weaned, and then choosing younger ones for breeders. The old sows will bear stronger and better pigs than young ones, will take better care of them, furnish them a larger quantity of milk, and be less liable to injure them. In every respect matured animals are better for breeding than those which are young.

The degree of success which will be attained by the farmer who attempts to raise pigs will, to a great extent, depend upon the care which his breeding stock receives. If the animals are neglected and half-starved, the pigs will be very sure to be of inferior quality. If well cared for, there will be much more certainty that their offspring will be good. The boar and sows should not be allowed to run together, but should have separate pens and yards. The boar should be kept in a thrifty condition, but should not be allowed to get very fat. He ought to have a

good pen and a dry yard. In summer he should also be allowed to run at will in a small pasture. Both yard and pasture must be strongly fenced.

The sow should neither be fat nor thin in flesh. Either extreme is highly injurious, and will exert a bad influence upon the pigs. Both before and after being bred the sow which is to have pigs should be kept separate from the fattening stock, and instead of the heavy feeding with corn which they receive she should be fed upon slops in which shorts and a moderate quantity of meal have been mixed. In warm weather, running in a clover pasture will prove highly beneficial.

Young sows go with young from one hundred to one hundred and six days. Old ones carry their pigs from a week to ten days longer. The best time for spring pigs to come is in April. Fall pigs should come in September. If the sow is to raise two litters during the season, she should be taken to the boar about the first of December, and again a few days after her first litter has been weaned. But if only one litter is desired, the pigs should not come until the days are warm, and danger of cold storms has passed.

The sow will come in heat every three weeks. She should be served by the boar only once. This is not only just as effective, but is a great deal better than it is to leave the two together over night, or, as some do, for a day or two.

While carrying her pigs the sow should be kindly treated, and regularly supplied with food and water. As the time for farrowing approaches, she should be put into a pen at night, and, while permitted to run in her yard and pasture during the day, she should be fed in the pen in order that she may become accustomed to it and regard it as her home. A few days before time for the pigs to make their appearance, a small quantity of straw should be put into the pen. Care must be taken not to use too much straw, as this will be likely to cause the sow to lie on the pigs. The pen should be closely boarded so that

straw will not be needed for warmth. If the pigs come in the winter, a coal stove should be set up in the building, and the temperature kept from going too low. In order to keep the sow from crushing her pigs between herself and the wall, a rail should be placed around the inside of the pen about six inches from the floor, and eight or ten inches from the walls. When this is provided, and only a little straw is used, there will be but little danger that the sow will lie on the pigs. But if either of these precautions is neglected the risk is very great.

If the sow has been made very tame by previous scratching and handling it will be well for the owner to watch her when the time for pigging arrives, and render assistance if it is needed. But if she is wild or cross, it will be best to let her alone. If she has been well fed and kindly treated she will be almost certain to get along well.

For a few days before and after the pigs arrive the sow should have light and sloppy food. The quantity should be abundant, but the quality must not be rich. She should have plenty of fresh water in addition to the wet food. While carrying her pigs she should be occasionally furnished with charcoal and ashes, and, if kept in a pen, with green grass or with sods.

If the sow shows a disposition to eat her pigs they should be gently rubbed with kerosene, which may be applied best with a woollen cloth or a soft brush. Only a little will be required, and too much will make them sore. When the diet of the sow has been properly managed, and she has had sufficient exercise, she will not be inclined to eat her pigs unless she has previously formed the habit when badly kept. Any sow which does this the second time should be rejected for a breeder.

CARE OF PIGS.—If strong and well, as most pigs which have suitable parentage and whose mothers have been properly cared for will be, they will look out for themselves. Most of the weak pigs are weak because either the boar or sow was too young to breed, or diseased, or not properly mated, or else because the

sow has been badly fed or kept in an unsuitable place. When weakness is apparent, the pigs must be got to sucking if possible. But if the sow is not gentle, or has no milk, they must be fed by hand until the mother is able to care for them. If she is fed with slops she will be likely to have milk for the pigs in from one to three days. Meanwhile the pigs must be fed several times a day with new milk from a cow. To this milk it may be necessary to add a little molasses.

When pigs are two or three weeks old they will begin to eat if suitable food is provided for them. The sow should be well fed with scalded bran, meal, and roots, in order that she may give a large quantity of milk, but it will be much better for her and for the pigs that they should have a little trough of their own, to which the sow cannot have access, in which they may be taught to eat. At first a little sweet milk should be given. Then add a few oats. As the pigs increase in size the quantity of food must be increased. They should always have all they will eat, but no more. They will soon be ready to eat soaked corn, and, after a while, scalded meal and bran.

The boars should be castrated when about six weeks old. If they are to be weaned early, the operation may be performed two weeks sooner. The method to be pursued is the same as described for castrating calves, except that one man should hold the pig from the ground by his hind legs while the operator is at work. For castrating an old boar MR. COBURN gives the following excellent directions: "After drawing up one hind leg, and fastening it securely to a post or stake, fasten another rope around the upper jaw, back to the tusks, draw it tightly, and fasten it to another stake; in this position the animal can offer no serious resistance. The cut should be low down, and as small as possible; the low cut will afford a ready means of escape for all extraneous matter, and allow the wound to keep itself clean, there being no sac, or pocket, left to hold the pus formed during the healing process. It is not best to perform

this operation when the boar is very fat, or the weather too warm, as the risk is much greater."

When a large number of hogs are kept and the services of some one who is competent to perform the operation can be secured, it pays to have the sows spayed when about three months old. MR. COBURN strongly advocates this, but says that "unless it can be done by a person understanding it, it is risky business," and expresses the opinion that there are "a thousand men who can do a tolerable job at castrating a boar, to one that is competent to properly spay a sow." On account of the difficulty, and, if not perfectly done, the danger of the operation, it will hardly pay the man who keeps only a few hogs to have it performed. The owner of a large drove can afford to hire some one who understands the best method, and it will pay him well to do so. Before undertaking this operation the beginner should, if possible, see it performed by some competent veterinarian. For the benefit of those who desire the information, but are not able to visit a surgeon, we will give the directions for spaying small animals which PROF. LAW has furnished in his veterinary work. "The animal is stretched on its left side, the fore limbs and head being firmly secured, and the hind limbs extended backwards. The hair is shaved from the flank a little below the angle of the hip-bone, and an incision made from above down, extending to an inch in the pig or bitch, or sufficient to introduce the hand in the heifer. Then with the finger or hand, as the case may be, the womb is sought, backward at the entrance of the pelvis in the interval between the bladder and the straight gut. Being found, one horn or division is drawn up through the wound until its end is exposed with the round mass of the ovary adjacent. The latter is seized and cut or twisted off according to the size of the animal. Then the next horn and ovary are brought out and treated in the same way. The womb is now returned into the abdomen, and the skin accurately sewed up." There are other methods of

performing the operation, but we consider this the best. After a sow has been spayed she must be protected from cold and storms. Turpentine or buttermilk should be applied to the wound if the weather is warm. If there is no danger from flies apply a little lard.

FATTENING PIGS.—In order to do this to the best advantage it is necessary to commence, and well to finish, the operation while the animals are young. It has been generally believed that old hogs would fatten more easily than pigs, but this is a great mistake. PROF. SANBORN, of NEW HAMPSHIRE, who has given this subject considerable attention, advises the farmer to fatten his pigs by the time they are six months old, and believes that the man "who keeps a pig more than eight months loses twenty per cent." There can be no doubt that early maturity is advantageous, and that it is best to fatten pigs rapidly. Many farmers feed their pigs lightly in the spring and summer, just enough to keep them growing slowly, and do not really begin to feed well until fall. This is an unprofitable method. From the day when the pig leaves the sow until it is killed, it ought to be fed so that it will make a steady growth and take on flesh as fast as it increases in size.

If the pigs have been fed while with the sow, as we have advised, they will suffer but little when weaned. Having been taught to eat while with her, they will eat readily when taken from her. At first they should be fed several times a day, early in the morning and in the evening, as well as in daylight. Milk, with a small quantity of corn meal which has been scalded, is the best food. If this cannot be supplied, slops and meal, or bran, should be given. There should be a clean and comfortable pen provided, and plenty of fresh water should be supplied. In warm weather, access to a good clover pasture should be given. With the age of the pig the quantity and quality of its food should be steadily increased.

It often happens that two or three of the pigs in a litter will

be much smaller at weaning-time than the others. Sometimes these pigs do not grow well, but we have known them to make the best hogs of the lot. They should have extra care and food. It is best to let them remain a week or two longer with the sow. This will be a great benefit to her as well as to them, as it will cause the flow of milk to cease gradually. Many of the best breeders never take off all the pigs at once, but leave two or three after the others have been removed, and then take these off one at a time. This is a wise method for all growers to follow.

A great deal has been said and written, and many experiments have been tried, in order to determine which is the best food for pigs which are being fattened. No great good ever has, or will, come out of these efforts. This because the pig, in common with all other animals, *needs a variety of food*, and no one article, however good, can in itself answer all the requirements of his system. Many farmers, especially at the EAST, wholly overlook the fact that the pig is a grass-eating animal and likes fresh clover as well as the cow. At the WEST there has been a too exclusive use of INDIAN corn, and terrible visitations of disease have been among the results. Undoubtedly, when fed as it should be, corn is the best article for fattening pigs which we have, but it is altogether too heating and concentrated to use alone. Fed with grass and roots, of which artichokes are highly prized at the WEST, and plenty of slops, it gives the best results in proportion to its cost of anything which the farmer can use. When the fattening process is to go on slowly, and the owner prefers to have the pigs attain a larger size before taking on much flesh, the use of boiled potatoes and milk will prove an efficient means for attaining the desired end. We use small potatoes in this manner and think they are more profitable than when fed to cows. A diet of grass and water, with a little meal, will also be good in warm weather. When the fattening process is to be hastened, the quantity of meal

should be increased or ears of corn should be fed. In order to provide for the summer drought, which usually ripens off the grass in pastures, some peas may be sown broadcast in the spring. These will not only furnish green food when it is most needed, but the peas will be found very beneficial. In CANADA, peas are extensively used for fattening pigs, and they will, in time, be more generally grown in this country.

It is not well to keep too many pigs in a single yard. Like all other animals, and to a greater extent than some, pigs need room. They want to exercise and they want to be clean. Though they like an occasional mud-bath, they do not like to be in mud all the time. When they have the opportunity they will keep as clean as any domestic animals. If large numbers are kept in filthy yards, or small pastures, disease is very likely to carry off a large proportion of them. Not only in order that the pigs may be comfortable, but also for the profit of the owner, they should always have plenty of room.

When taken from grass and shut into the feeding-yards, where meat is to be made with the greatest possible rapidity, the change of food should be gradual. Bran slop with boiled potatoes and a little meal should be given at first. Gradually increase the meal, or corn, and leave out the bran and potatoes. In a short time the hogs can be brought to full rations of corn without injury. The fattening should be done before cold weather. We do not believe the average farmer makes it pay to feed pigs during the winter for pork. If he has pigs, as he should, he must feed them, of course, but the aim should be to keep them thrifty and growing but not to fatten rapidly.

Salt should be given occasionally, and ashes should be placed within reach of the pigs. In all respects the animals should be made as comfortable as possible. They should always have food enough—all that they will eat clean—but should not be allowed to leave any. The food should never be thrown into the mud, but ought always to be given in a clean place.

Upon this point the NATIONAL LIVE-STOCK JOURNAL well says: "No hog will thrive when compelled to eat and sleep in the mud. Dry dust is almost as injurious as mud. Consequently, when hogs are confined to a small lot or pen, it is always the best economy to provide a good feeding-floor of solid boards for them. There is no more wasteful practice in feeding than that often seen on our WESTERN prairie farms, of hogs confined in an open pen, with the black prairie soil converted into a deep mud, in which they must both eat and sleep. Although all the grain may be sought out and eaten, no one ever saw hogs thrive under such treatment. The grain is simply wasted. It will pay to spend the price of a few bushels of corn in preparing good quarters at the beginning of the fattening season, and, when once prepared, the shelter and feeding-floor will last for several years. Content and comfort are absolutely essential to a rapid accumulation of fat." Even when the enclosure is large enough to give ample room, it is best to have a feeding-floor. If this is neglected, there will be many stormy days in which the ground will be soft, and the pigs must pick their food out of the mud. Besides, in cold rains and snow storms, they need the shelter which a well-constructed shed supplies. The hours of feeding should be regular, and ought to be very closely observed. Pigs which are always fed "on time" will gain flesh much faster than those which have the same quantity and quality of food, but which receive it at irregular intervals.

Whether it pays to cook meal for hogs which are being fattened, is a question upon which "the doctors disagree" as freely as they do upon the same question concerning the food for cows. That it is best to cook meal for *young* pigs we have no doubt, and there are many earnest advocates of cooking meal for pigs which are being rapidly fattened. Among the advocates are many very successful men who have had an immense amount of experience in the business of making pork. But many carefully conducted experiments go to prove that cook-

ing the meal does not pay. At the IOWA COLLEGE farm the result of a careful trial was strongly adverse to cooking the food. Messrs. J. M. BILLINGSLY, of SPRING VALLEY, INDIANA, and R. L. BINGHAM, of BLOOMINGTON, WIS., each tried the experiment on quite a large scale and in a very careful manner with the same result. MR. H. P. BEATTIE, of DAVENPORT, IOWA, whose hog-pen cost nearly one thousand dollars, and who has a "steam-engine, corn-stone, corn-sheller, vats, and every convenience that money could purchase," and keeps a large number of hogs, tried cooking their food for three or four years, ground all his grain, and has "come to the conclusion that there is no advantage in cooking food for hogs." At the MAINE AGRICULTURAL COLLEGE, a six years' trial proved that there the "raw corn meal for feeding swine is more economical than meal that is cooked." In commenting upon the results of this last experiment, the editor of the NEW ENGLAND FARMER says: "This accords with our own experience, although contrary to common opinion." Upon this point MR. COBURN says: "The surrounding conditions and circumstances have much to do in deciding the question of economy; and while one farmer, under certain circumstances, could feed a considerable portion of cooked grain and secure satisfactory returns therefor, another, differently situated, though perhaps in the same neighborhood, and raising the same class of swine, might be unable to do so without actual loss." This we believe to be strictly true. The circumstances of each farmer must be a controlling influence. No one rule will apply to all cases, and a practice which will pay one man may involve his neighbor in a heavy loss.

DISEASES.—Nearly all of the diseases of pigs are brought on, and all of them are aggravated, by improper feeding, exposure to the weather or to contagion, or the use of unhealthy and badly-mated breeding-stock. Here, as with other animals, the great reliance of the farmer must be placed upon prevention. Many diseases may be prevented which cannot be cured, and those

which are curable involve a great loss to the owner of the stock which inexpensive preventive measures would save. Besides a hog is one of the worst of all animals to doctor. Medicines are best given in his food. If so far gone that he will not eat, he may be turned out of his pen and left to his own devices, or, if desired, medicines may be poured down his throat. The former method we have tried successfully, the latter we have never tested.

In summer when a pig refuses to eat, turn him into a field in which he can have water and shade. He will be quite likely to burrow a deep hole in the earth, get into it, and lie there from ten to twenty-four hours. Then he may come out of his trouble and remain perfectly well. In winter the sick pig must have a warm nest, plenty of fresh water, and gruel if he wants it.

Among specific diseases the so-called "hog cholera," which sweeps off millions of dollars worth of animals every year, is the most dreaded and the least understood. That it is extremely contagious, and may be carried on the shoes or in the clothes of men visiting an infected herd, there can be no doubt. That aside from the contagious influence the disease might be prevented in any given herd seems to be admitted by the best authorities. The men who feed properly, give plenty of room, and fresh water, would not be likely to lose hogs from this disease if they were not exposed in some way to the contagion. The two things to be done are to be careful about the feeding and surroundings, and to avoid all possible sources of contagion.

Many remedies have been advertised for this disease, but a genuine specific does not seem to have been found. The editors of the NATIONAL LIVE-STOCK JOURNAL have refused to advertise these remedies because they "honestly believe them to be practically worthless as cures for the disease. It may be that some of them possess value as tonics; but the man who buys any of the so-called cholera cures, believing that he has some-

thing that will prevent hog cholera, or cure it after it has attacked his herd, is destined to disappointment." That some affected herds have been treated with a certain degree of success is true, but we think the cleansing of the premises, the change of diet, and the increased attention that was given had much to do in securing the good results which have been attained. Medicine alone, without regard to diet and surroundings, will be of no avail. When this, or any other, disease appears, the sick animals should be immediately separated from those which are well. A good veterinarian should be employed when the "cholera" first appears, and the pens and yards should be put in the best possible condition. Some of our most eminent veterinary physicians have been closely studying in order to find the causes, and, if possible, a remedy for this disease. Part of them are still at work, and it is to be hoped that their investigations will lead to the discovery of means for preventing the fearful loss which for a few years past the farmers of the West have been obliged to sustain.

DIARRHŒA carries off many little pigs, and injures many which survive its attack. Improper feeding of the sow if the pigs are sucking, and of the pigs themselves if they have been weaned, is the most frequent cause. Still many attacks are brought on by breathing impure air, drinking dirty water, and taking cold. When sucking pigs are attacked, the sow should be kept on dry food for a few days. Pigs which have been weaned can usually be cured by giving dry food, but if this fails give a teaspoonful to a tablespoonful of prepared chalk twice a day. Keep the pen clean, using dry earth in summer and chloride of lime in winter as a deodorizer, and secure thorough ventilation.

CONSTIPATION, though not immediately fatal, may, if neglected, lead to serious results. A change of diet will usually be sufficient to effect a cure. In summer give plenty of clover and roots. In cold weather warm bran mashes with the addition of flaxseed tea or slippery-elm water will be safe and reasonably

sure. If these fail, an injection of warm soap-suds in which an ounce of Epsom salts has been dissolved should be given.

Worms of various kinds give a great deal of trouble to pigs. The simplest treatment for an ordinary case is to give some soap-suds and wood-ashes in the swill. Measles, similar to the tape-worm in man, is regarded as an incurable disease, but can be prevented without great difficulty. No human excrement should be spread upon swine pastures, or used for growing roots which are to be fed raw, and pigs should not be allowed access to it at any time. Contact with an infected herd had better be avoided, though it might not communicate the disease.

Mange is a troublesome disease similar to the itch in man. It is very contagious, and, like the scab in sheep, may be spread by contact with a rubbing-post which has been used by a diseased animal. The affected animal should either be covered with soft soap, washed off three or four hours after its application, or else washed in tobacco water, or water in which caustic potash has been dissolved in the proportion of one part potash to fifty parts of water. Two days after the first treatment wash the animal thoroughly in strong soap-suds. The pen and fence should be washed with a strong solution of caustic potash.

Lice may be removed by the use of tobacco water or a light application of kerosene oil. Carbolic acid with three times the quantity of water may be used instead of the above. The liquid should be rubbed upon the back, behind the fore legs, the flanks, and between the hind legs.

RHEUMATISM.—This is almost invariably caused by exposure to dampness, sleeping on the cold ground, or lying in filthy pens. The preventive measures are cleanliness, warmth, and protection from storms. In the line of treatment, MR. COBURN recommends a tablespoonful of cod-liver oil once or twice a day. This should be mixed with the food. For large pigs give twice the quantity. Keep the pigs warm and give soft food.

CURING PORK.—There are only two methods by which the

average farmer can keep pork in a good condition for any length of time. One of these, which is by keeping it at a low temperature, can be used only in the winter. The other, which involves the use of some preservative substance, can be made successful during the larger part of the year. In the winter, fresh pork can be kept at the NORTH for some weeks by packing in snow and placing where it will be kept frozen. After it has thawed the meat will keep but a short time.

Salt and smoke, the two preservative substances in common use, can be applied at all times except when the weather is very hot. But if used in the summer a great deal more care and skill will be needed than is required in the winter.

Before being either frozen or salted, the meat must be thoroughly cooled. It is to the difficulty of effecting this that the main trouble with salting pork in hot weather is due. After the hog is dressed he should hang until well cooled off, but must not be allowed to freeze. It is sometimes best to split the carcase down the back in order to facilitate the cooling process. When well cooled, the pork may be cut and the parts left in a cool place for a while so that all the animal heat may escape. The outsides of the thick pieces will cool much sooner than their centres, and meat often fails to keep well because, though well enough on the exterior, it was not cooled at the middle and around the bones.

The fat pieces are best preserved with salt. They may be cut in any desired shape and packed closely into a barrel. Unlike some kinds of meat, pork will absorb no more salt than it needs. Still, there is no benefit to be secured from using an excessive quantity. Eight or ten pounds of salt for one hundred pounds of pork will be sufficient. The easiest way to salt pork is to cut it into pieces of convenient size, cover the bottom of the barrel in which it is to be kept with a layer of salt half an inch thick, upon this place a layer of pork, then another layer of salt, followed by another of meat, and so on until all is packed. The

pieces should wedge into the barrel in such a manner as to cover nearly all of the surface. If this is neglected, a large quantity of salt will be needed to fill the openings. The top layer of meat should be covered with salt, and a close-fitting cover placed upon the barrel.

Many farmers prefer to use brine instead of relying upon dry salt. The pork is to be packed as directed above, and pure water poured into the barrel until all of the spaces are filled and the meat is well covered. A board which will just go inside the barrel, like a follower to a cheese hoop, should be fitted, with several holes bored through it, placed upon the meat and a weight put on to keep it in place. This is needed in order to keep the meat from floating in the brine.

A method which we consider much better than either of the above is to use a prepared brine. The following recipe for making brine for one hundred pounds of pork is as good as any with which we are familiar: Dissolve in pure water, using just enough to fully dissolve the materials, four ounces of saltpetre, two pounds of good brown sugar, and seven pounds of salt. When thoroughly dissolved, the mixture should be boiled and all the impurities, which will rise to the surface, skimmed off. When this is cold it is to be poured over the meat and the board and weight put on as already recommended.

The hams and shoulders can be put into a brine (made as directed for the salt meat) or be covered with a mixture of fine salt, molasses, and saltpetre, using, for one hundred and fifty pounds of meat, twelve pounds salt, two quarts molasses, and one-half pound saltpetre. Mix these articles well and rub the meat thoroughly, then lay away in a cool and dry place. Rub the meat again at the end of a week and once more a week later. The smoking process may then be commenced. This should be done slowly but thoroughly. About ten days' time will be required for pieces of ordinary size. Many people pickle the meat well in brine and use it without further curing.

Except in cool weather, a great deal of care must be taken, both before and after the curing is performed, to protect the meat from flies. The smoked meat can be covered with canvas, packed in tight barrels, or well buried in a bin of shelled corn.

It has been often said that meat cannot be salted successfully during "dog-days." That this is not a good time to salt meat must be evident to any one, and, under ordinary circumstances, the work should be delayed until a more favorable season. But, as some of our readers may find it convenient to put down meat at this time, we will give a method which was reported, by a lady, in the *AMERICAN CULTIVATOR*. We have never tested the plan, but it was recommended by a worthy minister, and tried by the lady who sent the report, and is said to be safe and sure. The method is described as follows: "Put in plenty of salt and it will be apt to keep. But if it should begin to hurt, take it out of the barrel, meat, brine and all. Then get a quantity of smart-weed and pack the pork with the weed back into the barrel; lay plenty of it all around each piece, or you can pack it in layers of the weed. Let it remain four or five days, then take it all out, throw away the smart-weed, and pack the pork in the barrel. Then pour on the brine, having previously scalded, skimmed, and cooled it. Never put warm brine on meat. Your meat will then be all right." This plan is very simple and well worthy of a trial by those who salt pork in extremely hot and sultry weather. But it is much easier to prevent mischief than it is to cure it, and, except under peculiar circumstances, it will not be wise to attempt to salt pork in the mid-summer months.

THE INFERIOR ANIMALS.

THERE are a few classes of animals which can be profitably kept upon many farms, but which, owing to their small size, or the limited range of their usefulness, do not receive that degree of attention which is bestowed upon the classes which we have thus far considered. To these animals a brief space should be devoted.

HENS are kept upon almost every farm, and may be made to pay well. But in order to be profitable, they should receive some degree of attention. If exposed to cold and storms, and kept half-starved, they can neither take on flesh nor produce eggs. A good house should be provided for their accommodation. This should be kept very clean. In it feeding-troughs and drinking-pans should be placed. These should be so arranged that while the fowls can eat and drink freely, they cannot get into the vessels. Roosting-places should be provided, and instead of putting up the perches in tiers, the front one being the lowest, the next one a foot or two higher, and so on until the last and highest one is reached, they should all be placed on a level, and only three feet from the floor. This is very much better than the old method. When the perches are of different heights, too many hens will try to get upon the highest one, the weaker ones will fall or be crowded off, and falling so far may be seriously injured. The perches should be made of small poles of sassafras-wood or wild cherry when they can be obtained.

Connected with the house should be a good-sized yard in which the hens can stay in pleasant weather. They like to get on the ground, and will be much more healthy if allowed to do so. If the garden is not close by, it will be well to let the hens out for an hour each day. Between four and five o'clock in the afternoon is the best time. When the orchard is pastured, it is well to give the hens a chance to run among the trees, as they

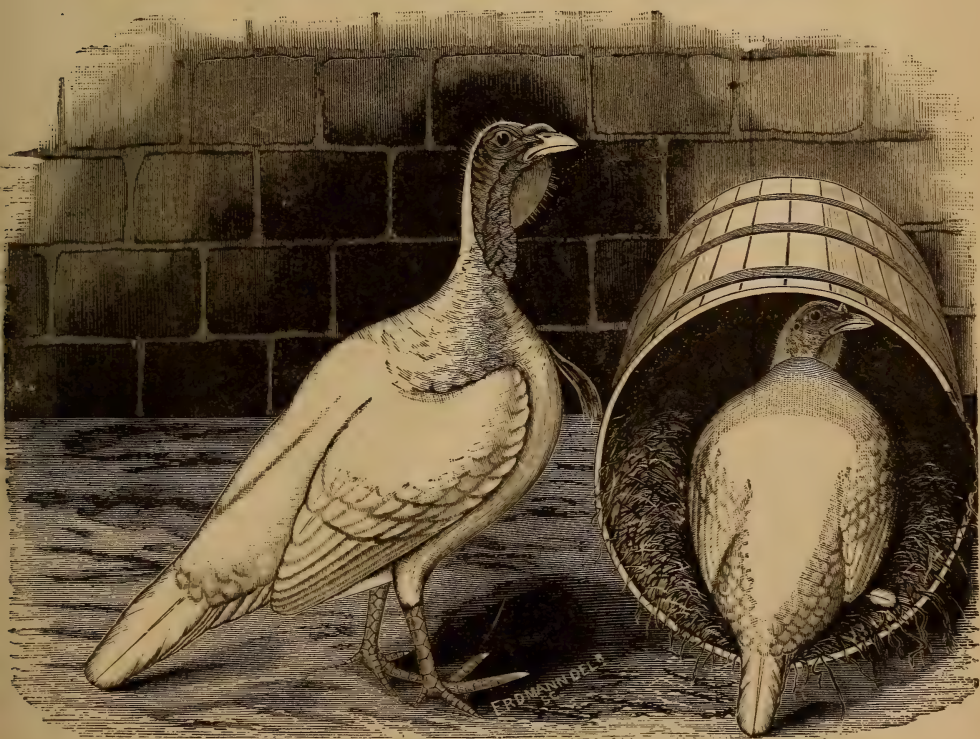
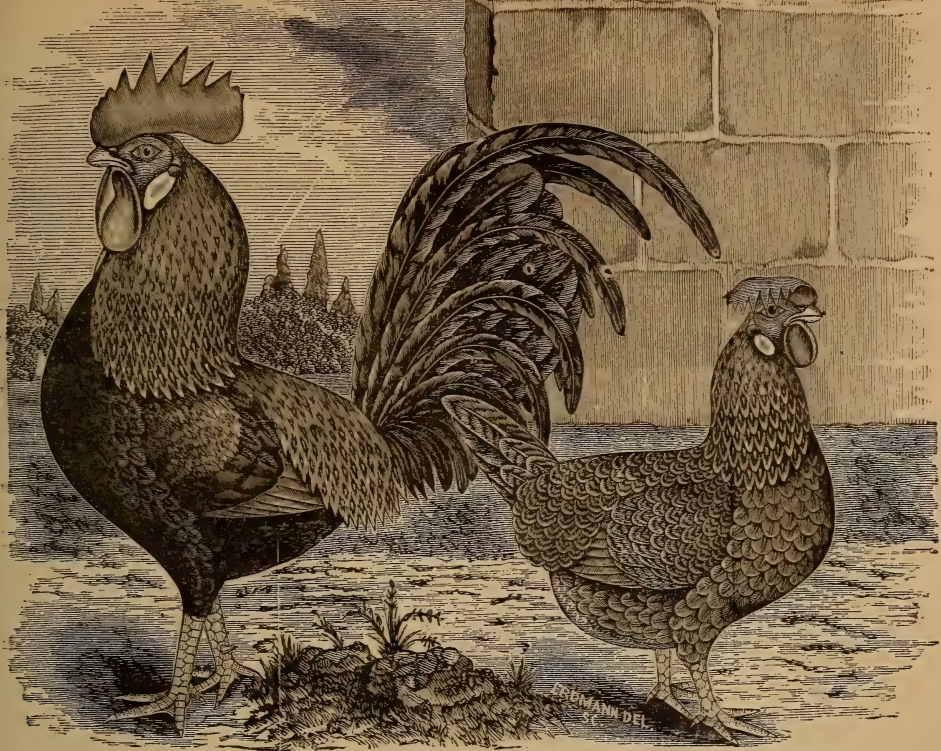


FIG. 114.

will destroy a multitude of worms, but if the grass is to be made into hay they will tread it down, and do more hurt than good.

Too many fowls must not be kept together. A larger number can be kept in a large house and commodious yard than can be safely put into close quarters, but there is a limit to the number which can be profitably kept in a single enclosure.

WHICH BREED to keep is a question over which many farmers have a great deal of needless perplexity. Any good breed is better than hens belonging to no breed, but any one of half a dozen breeds will do well enough if they receive good care. If the farmer wants to raise chickens for the market, or his own table, the BRAHMA, COCHIN, PLYMOUTH ROCK, or DORKING, will answer his requirement. If he does not care particularly for chickens, but wants eggs, the LEGHORN, HOUDAN, or the HAMBURG will give satisfaction. There are also several other excellent breeds which we have not room to notice.

By purchasing a few eggs it is easy to obtain fowls of any desired breed for a low price. These should be bought as near home as possible, as transportation often destroys the vitality of eggs which were good when they were sent, and causes the seller to be unjustly blamed, as well as involves a loss to the buyer. It is not necessary that the farmer should keep the breed perfectly pure. Many prefer to cross a pure-blood male with their finest native hens. Of course the chickens obtained in this way must not be sold for pure-blooded ones, but they may be just as good to fatten, or to produce eggs as the thorough-breds.

RAISING CHICKENS.—When a hen desires to sit and chickens are wanted, some fresh eggs should be obtained, and either put into the nest which she occupies, or else a nest should be made for her in a suitable place, the eggs put into it, and the hen put over them in the evening. It is a good plan to put some tansy into the bottom of the nest. Do not put in too many eggs.

A small hen should have only nine, and a large one not more than thirteen. Plenty of food and fresh water should be placed near the nest, so that the hen need not be off long at a time. In three weeks the eggs should hatch.

The chickens should not be hurried from the nest, and they do not need food for twenty-four hours after they are hatched. Then give them a boiled egg, cut into in the middle so that they can pick out the meat. After this feed with soaked bread and oat meal pudding for a few days. Begin to feed cracked corn gradually with the oat meal. Also give INDIAN meal pudding part of the time. Chopped meat is good for them, and green food, grass, lettuce, or cabbage leaves will be relished and prove beneficial. For a few weeks they must be protected from cold and storms. Give them plenty of ashes to roll in, and all the pounded oyster-shells and ground bone they want to eat. Feed well with a variety of food, giving grain, vegetables, and animal food in abundance. Furnish plenty of fresh water, and give them room in which to exercise. Feed regularly and keep them growing every day.

When it is time to fatten them, if the chickens have been treated as above advised, the work will be already well begun, and may be very soon completed. The fowls should be shut into a house, or coop, two or three weeks before they are to be killed, and fed with INDIAN meal pudding given warm, and warm baked potatoes. The addition of barley meal to the pudding is beneficial. Fresh water should be supplied, and all the food the chickens will eat should be given. Fowls which have not been well fed should be shut up a much longer time.

Hens for laying must be well fed or they cannot furnish a large number of eggs. They should have room, clean quarters, comfortable surroundings, fresh water, and a variety of food. Ashes, ground bones, pounded oyster-shells, and gravel should also be supplied. Food should be clean, of best quality, and a large variety of grain, vegetables and meat should be furnished.

Oats fried in lard are excellent for part of the winter diet. Corn should be given sparingly, as it tends to fatten the hens rather than make them lay eggs.

Some breeds are better layers than others, but no breed will, or can, lay all of the time. Hens must have rest as truly as other animals. There are some breeds highly recommended as winter layers. These, generally, do not furnish many eggs in summer. The hens which lay well in the summer will not lay all winter. In order to have eggs at all seasons hens of different ages must be kept, and it is well to have some of two different breeds, one of which is noted for winter and the other for summer laying. The latter is not indispensable, but the former is an absolute necessity. If the hens are all of the same age, they will all lay at about the same time and stop laying together. But if hens of several different ages are kept, some of them will lay while the others do not, and when one brood ceases another will be ready to begin.

It does not pay to keep old hens. During the first year of life the hen lays more eggs than she does during the second, and the number produced gradually decreases as she grows older. The eggs of old hens do not give as strong chickens as those of younger ones, and, except for sitting, the old hen is poor property.

When chickens are to be raised, one male bird should be kept for each ten or twelve hens. He should be thorough-bred, and always well cared for. It is not well to keep him after he is two years old, but during the second year he will be better than he was before. If only eggs are wanted, no male need be kept.

If properly kept, fowls will seldom be sick; but if badly fed, kept in dirty quarters, furnished only with impure water and foul air, they will be very liable to disease. The wise owner will prevent attacks of disease, as far as he can, by keeping the hens and their surroundings in as good condition as possible.

If sickness comes, when the cause is evident that cause should be at once removed. If there is no apparent cause, if the feeding and surroundings are right, take the invalid to a block and cut off her head. It does not pay to doctor a sick hen. The chances are that she will die and also scatter disease and death among the whole flock. Some breeders feed chopped onions occasionally, in order to promote the health of their fowls. Others give half an ounce of sulphur in the food of twelve fowls two or three times a month. Either of these plans will prove beneficial.

Lice are very likely to find a home on hens, and do a great deal of mischief. They may be kept away by dampening the bottoms of the nests and washing the perches occasionally with kerosene oil. If the house is shut up tight and some brimstone burned in an iron vessel placed upon the floor, then ventilated after two hours, and the inside of the building washed in a strong solution of potash, and then painted with kerosene oil, the old hay taken from the nests and new hay moistened slightly with the oil put in, the work of extermination will be complete.

Eggs may be kept for a long time, and be just as good as new, by packing in a stone jar, and covering them with a liquid made of four gallons of boiling water, one pint of lime, and one pint of salt. The lime and salt should be dissolved in the water, and the liquid used when cold. This plan is highly recommended by MR. BURNHAM, of MASSACHUSETTS, the author of several valuable works on Poultry.

TURKEYS can often be profitably kept by farmers who live in thinly settled sections. The eggs should be put under a large hen. About four and a half weeks are required for hatching.

Young turkeys are extremely tender, and must be carefully handled. A few hours after they break the shell, they should, with the hen, be put into a coop which stands in a warm and dry place. For at least a month they must be kept from the

hot sun, must be shut into the coop in rainy weather, and must be kept in every morning until the dew is off the grass. The coop must not be placed on grass land, and should not be close to the mowing-lots. The food should be carefully prepared and regularly given. Commence feeding the chicks, when six or eight hours old, with boiled eggs and crumbs of bread broken into fine pieces. After a few days, boiled sour milk with cooked INDIAN meal may be given. Uncooked meal should not be given to young chicks. A little meat chopped fine may be given occasionally, and oat meal dough will be good for a change of diet. Feed often and provide plenty of fresh water. The latter should be so arranged that they can drink when they choose, but still be unable to get into the dish containing it.

Until they are three months old, the young turkeys must be *kept dry* and very carefully fed. After this time they must be fed well, but will be able to look out for themselves to quite an extent. They may be profitably fattened at any time after they are five months old. When it is desired to fatten them quickly, they should be shut into a comfortable pen, and fed on cooked meal, boiled potatoes and oats. It is said that mixing a small quantity of charcoal, finely pulverized, with their food proves a great advantage. Plenty of pure water should be given, and clean gravel should also be supplied.

Ducks require either a suitable locality or else very careful management in order to enable them to pay the expenses of their keeping. The former but very few farmers have, and the latter but very few are willing to give. In order to raise them to the best advantage the farmer should have a pond on his premises or else live near a river, marsh, or large brook. The ducks will naturally take to water, and will wander away in search of it if it is not close by. When no pond or brook is convenient, large tubs of water should be put out for the ducks to swim in.

The eggs may be placed under a duck or a common hen.

When hatched, the chicks should be put into a coop, and kept therein for a while unless the weather is very fine. Large but shallow pans of water should be placed close to the coops. These pans should often be emptied and filled again with fresh water. For food they should at first be supplied with bread-crumbs soaked in milk, and hard-boiled eggs chopped fine. In a short time they will eat boiled INDIAN meal and milk, boiled potatoes, and green stuff from the garden. By the time they are three months old they will eat almost anything which any fowl can swallow, and will need an immense amount of food. They may be allowed to run in the garden, where they will get many worms, but should be kept out of the grass which is to be cut for hay.

GEESE need water and green food, but if plenty of the latter is given they can be kept where there is neither a pond nor stream. Still, they do much better when they can sail on a pond at will. Whether they can be made to pay on the farm is a question which most farmers will probably answer in the negative. A few, who live near large cities in which the flesh can be readily sold, and who have water on their farms, may make some money by keeping geese.

An old breeder has said that the principal requisites for success with geese are "*good housing and feeding.*" Though they like to swim in the water, dampness about their houses proves very injurious. Geese should have a house by themselves, as they are quite apt to quarrel with other fowls. A gander should be kept for five or six geese. Not more than six or eight of these birds should be kept in one house, and plenty of dry straw should be furnished.

When a goose is about to commence laying, which will be evident by her gathering straw, she should be shut up. As she will be likely to continue laying wherever she drops her first egg, it is quite an object to induce her to begin in her appropriate quarters. If the eggs are allowed to remain in the nest, the

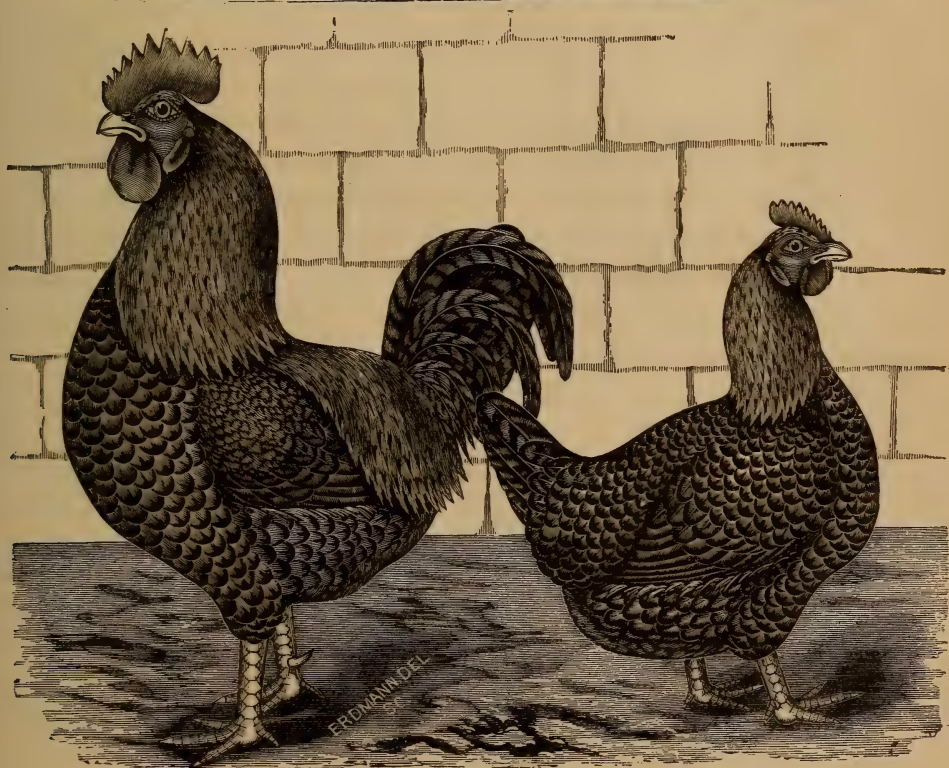
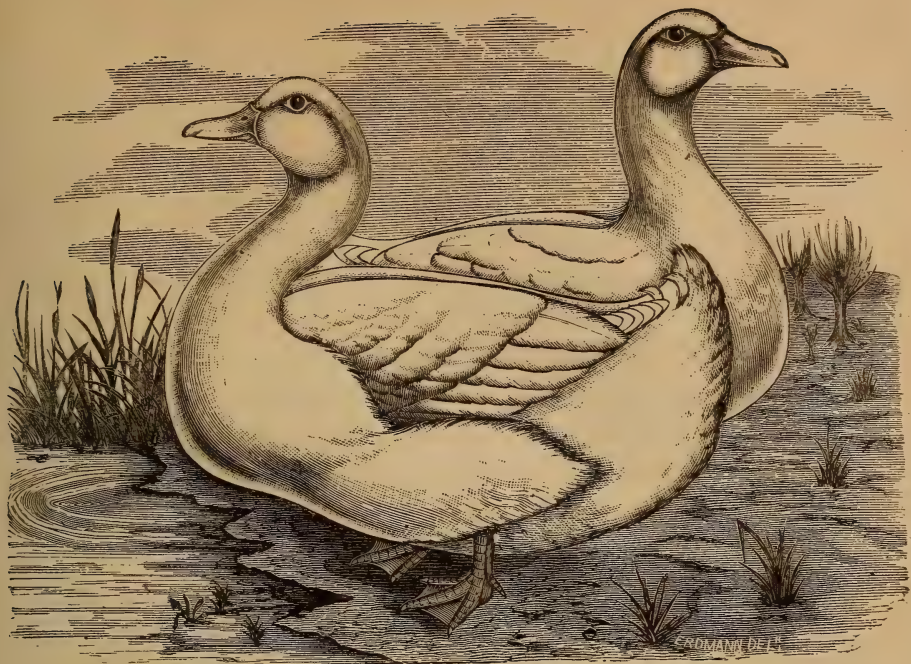


FIG. 115.

1. PEKIN DUCKS. 2. PLYMOUTH ROCK FOWLS. Owned by Benson, Maule & Co., of Philadelphia, Pa.

goose will lay only from ten to twenty, but if regularly taken out she will lay many more. When she wants to set, put fifteen eggs in the nest. She should have food and water near the nest, so that she will not be obliged to be off long at a time. The eggs hatch in about four weeks. The goslings should be taken out of the nest as fast as they are hatched, put into a basket of wool and covered with a cloth. When the hatching is completed, the little ones should be put back. Twelve hours afterwards they should be fed with bread-crumbs soaked in milk, bran pudding and boiled potatoes. The food should be given quite warm. They must be protected from storms, and should not go into water until two or three days old.

Geese eat a great deal of grass, and like green food from the garden extremely well. In addition to what they can pick up for themselves they should be regularly fed morning and night. When they are to be fattened, grain should be given, and plenty of warm boiled potatoes, oat meal and milk, or else meal mixed with water. They should also have green food in abundance.

HONEY BEES.—Farmers who have time, and a good location for keeping bees, may make it profitable to try the business on a small scale. But where it must be pursued at a disadvantage, and the care of the bees is irksome, there is little use in making the attempt.

If any one chooses to make a trial of the business of bee-keeping, a few things must be borne in mind. The very first thing to be done is to get a comprehensive work on bee-culture, which is up to the times (KING'S BEE-KEEPERS' TEXT-BOOK is an excellent one, and is very cheap), and study it. This must be done in order that the work may be commenced intelligently, and that mistakes involving heavy losses may be avoided.

Then some good hives must be obtained. It is not necessary to get the newest style of expensive hives, but it is wasteful and foolish to use the old boxes which were common thirty years ago. Good bees must also be secured. There is as much

difference in bees as there is in the different breeds of cattle. When buying an effort should be made to get those which are the best adapted to the conditions under which they are to be kept. They may cost a little more than poor ones, but they will be three times as profitable. Provide a good place for them in the summer, and a dark, but dry and well-ventilated, cellar in which to keep them in the winter. Get a honey-extractor, knife, some rubber-gloves, a veil made for the purpose, and all other necessary implements and fixtures. Then take good care of the bees, study their habits, and supply their wants. Furnish them plenty of buckwheat and clover pasturage in summer, and do all that can be done to aid them in their work.



FIG. 116.—JERSEY BULL, LEBROCQ'S PRIZE 3350,
Imported August, 1878, by CHURCHMAN & JACKSON,
Indianapolis, Ind.



FIG. 117.—BERKSHIRE PIGS. Owned by T. S. COOPER,
Coopersburg, Pa.



FRUIT-GROWING AND GARDENING.

(769)

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FRUIT ON THE FARM.

THAT there should be a liberal supply of fruit grown on every farm is a fact which no extended argument is needed to enforce. Fruit is almost as much of a family necessity as bread. Its free use tends strongly to prevent disease. It furnishes nutriment to the system, and as an article of food is of great value. It also gratifies a natural appetite, and is a source of a great deal of enjoyment.

Fruit should also be grown on a farm for the sake of the profit which its culture insures. It is very fashionable just now to say that fruit-growing does not pay. Farmers, who own large apple-orchards, assert that they are of no benefit. They say that the trees only bear every other year, and that the market is always so crowded with fruit when they have some for sale, that it hardly pays the expense of gathering and marketing. But this argument of crowded markets and low prices has been advanced against almost every crop ever grown on the farm, and yet the owners grow these same crops, and make money enough to support their families, and pay their taxes. There are times, it is true, when fruit sells for very low prices. But all this is true of all other crops. It is also true that there is a partial remedy for this difficulty. Better care and more skilful treatment can make the difference between the bearing and unfruitful years less marked, can improve the quality of the fruit, and increase the price for which it can be sold. There is, also, a strong probability that there will be a permanent market for AMERICAN fruits, in very large quantities, in foreign lands.

Even in the worst seasons, fruit will be very sure to pay all the cost of its production, and will enable the farmer to turn his time and labor into money. In times of scarcity, it will pay still better; while in average seasons, it will be a source of considerable profit.

Another reason why fruit should be grown upon every farm may be found in the fact that it will increase the selling-price of the land. This fact is not fully realized by the majority of farmers. But it is a fact that a good orchard will do more towards selling a farm for a high price than many other things which are a great deal more expensive. When a man puts out a lot of nice fruit trees, he then and thereby makes a permanent improvement of great value. If he thinks a farm without fruit trees will sell just as well as one with them, he has only to try the experiment to be undeceived. A farm which is well stocked with fruit trees is worth much more money, and can be sold much more readily, than it could, if there had been no trees put out.

Farming and fruit-growing naturally go together. A farm without fruit is deficient in one of the finest products of the soil. Of course, fruit can be grown in such a manner that it will not pay. The same is true of corn and of all other crops. It would not be wise to cover the best half of the farm with trees. But between the two extremes of growing no fruit at all and producing a large over-supply, there is a middle course which will give the farmer and his family a great deal of comfort, and add quite a sum to the actual profits of his business.

TRANSPLANTING TREES.

IT is very important that the land devoted to an orchard should be thoroughly prepared, and that the work of transplanting the trees should be carefully performed. If the soil is wet, it should be well drained before the trees are put out.

The soil should be made very fine and mellow. If this is neglected, and the earth which is thrown upon the roots of the trees is in coarse lumps, there will be many spaces into which the air and water will penetrate, and the ground will freeze much harder in winter than it would if the dirt was fine. The soil should also be very fine in order that the little fibres of the roots, which are the feeders of the tree, may obtain the nourishment which they need. Until a tree gets well started, it needs all the food which it can obtain. Removal from a nursery will be very likely to check its growth considerably, if it has the best of treatment which the buyer can give. If carelessly put out, the tree will grow but little for many years. The question whether at the end of ten years the orchard shall be productive and profitable, or the trees shall be small and stunted, with hardly fruit enough upon them to prove whether or not they are true to name, is, in a very great measure, decided at the time the trees are put out.

It is very true that trees need care and food after they are set, and that no amount of skill or labor at any one period can atone for neglect at all other times; but it usually follows that a man who has put out trees in a finely prepared soil and done the work with the highest degree of skill of which he was capable does not stop there, but gives all needed care to his growing trees. On the other hand, the man who puts the trees out in a careless manner is very likely to neglect them ever after. They do not start very well, he thinks it is doubtful if they ever "come to much," and so he lets them go to their natural doom. Thus it happens that the time of setting is a critical one in the life of the tree, and an important one in the relation which it bears to the financial interests of the owner.

It is not best to use large quantities of stimulating manures in the vicinity of the trees. It is much better to make the land very rich before the trees are put out, and then fertilize moderately each year. But in some manner the land must be made fertile if it is not already rich, or the orchard will not pay.

Fruit trees may be grown on the farm and grafted when quite small, or, what is usually a better way, purchased of some reliable nurseryman who has a reputation to sustain, and who thoroughly understands his business. Buying of unknown peddlers has involved many farmers in a heavy loss. There is no excuse for purchasing trees of irresponsible parties. There are plenty of reliable nurserymen, and trees can be packed so that they can safely be transported to all parts of the country.

If trees cannot be set as soon as they are received, they should be taken to the garden, their roots placed in a trench and covered with earth. If they are to remain in this position several days, the tops should be shaded from the sun. In this manner they can be kept alive for some time, but it is better to set them as soon as possible.

The method of setting trees is simple, but the work should be carefully performed. All the broken or mutilated roots should be trimmed with a sharp knife, and three-quarters of the previous season's growth of the branches should also be removed. **This is very important, as a large part of the root-surface has been removed, and the**

natural balance between the roots and the branches has been destroyed. A large, but not deep, hole should be dug, and the roots of the tree dipped into a bed of thin mud. The tree should then be put in the place which it is to occupy. It should not be set deeper than it originally stood.

If the trees are large, a strong stake should be driven down for a support. This should be done before the roots are covered. Then fill the hole with finely pulverized earth. Care should be taken to straighten out the fibres, and to pack the earth very closely under and around all the roots. It is well to carefully tread the dirt two or three times, and if the ground is dry the use of water for settling and compacting the soil is to be highly commended.

When the hole is filled tie the tree to the stake. A piece of woollen cloth, or some straw, should be placed between the stake and the tree in order to prevent chafing of the bark. Then mulch well with straw or coarse hay. Write the name and location of each tree, with the date of its setting, in a book which will be preserved for reference. Then take care of the tree, manure it well when it needs to be fertilized, and it will soon become fruitful.

Whether the spring or the fall is the best time for setting trees is an undecided question. Each season has many and strong advocates. As far as theory goes, we think those who favor setting in the fall have the advantage; but in practice, we have much the best results from spring planting. In other locations the reverse may prove true. At the SOUTH an intermediate time should be chosen. Far SOUTH mid-winter is considered the best time. In other sections it will be well to try both spring and fall setting, and choose that which experience proves to be the best for the particular location. Still, seasons differ greatly, and an unfavorable spring succeeded by a favorable fall may point to the latter time as the best when a longer trial would reverse the decision. On this account the test should be made several times.

In starting an orchard the great majority of men who have not been taught better by practical lessons derived from their own personal experience crowd the trees too near together. Trees need a great deal of room, and, if they are to do their best, they must have this requirement fully supplied. The roots of a good-sized fruit tree occupy a large area of land, and the branches spread to quite a distance from the trunks. If the trees are crowded, the roots will not have room for their proper development, and will not be able to obtain sufficient food to promote the rapid growth of the trees and make them productive. The branches will also interlock and interfere with each other. This will keep out the sunlight which is needed for ripening and coloring the fruit, and for drying off the ground after rains. It will also make it difficult to get around among the trees, and increase the labor of picking the fruit.

When trees are small they require so little room, that, if set as far apart as they ought to stand when grown, there will seem to be a great waste of land. On this account it is well to set dwarf trees between the standards. During the life of the dwarfs there will be room for all, and, when the dwarfs are gone, the others will rapidly occupy the land. This, where a nice orchard is desired as soon as possible. When there is no haste, and appearances are not specially cared for, the dwarfs may be omitted. Place the large, strong-growing sorts of apple trees forty feet apart. The smaller kinds may stand from thirty-three to thirty-five feet from each other. If dwarfs are to be grown, place them, in the rows, just half way between the standards. Pear trees should be grown twenty-five feet apart. Dwarfs fifteen

feet from each other. Peach trees should stand twenty feet from each other, unless a vigorous course of pruning is to be pursued. In this case, fifteen feet will give sufficient room. Standard cherry trees should be twenty feet apart. Dwarfs, from ten to twelve feet. Dukes and Morellos need only fifteen feet for standards and eight to ten for dwarfs. Plum trees should be fifteen feet apart, and quince bushes from six to eight feet.

On an ordinary farm a few trees should be set each year. When this is done, time enough can be spared to do the work well, and the trees will be more likely to receive needed care than they will if a large number are put out at once. Then, too, there will be trees in all stages of growth and productiveness in the orchard. As soon as an old tree begins to fail it can be removed, for there will be plenty of younger ones which will come into bearing as fast as the older ones fail. There will also be a greater probability of securing fruit every year if trees are regularly put out. Some of the trees will be likely to come into bearing during the odd years when most of the large trees are unfruitful. Experience has fully proved the superiority of this method over the "once for all" practice of setting an orchard, and we have no hesitation in recommending the putting out of a few trees each year. The cost is small, the labor insignificant; but the returns, though gradual, will be abundant in quantity and satisfactory in quality.

CULTIVATION AND PRUNING.

IF a fine tree is well set out, and then allowed to care entirely for itself, it will not be very productive, and the quality of the fruit which it does produce will be decidedly inferior. Therefore, we think it will pay the farmer well to cultivate the land devoted to trees for a few years after they are put out. Old trees can be heavily mulched and well manured, and thus be able to get along better without cultivation than small ones. The land in a young orchard need not remain idle. A crop can be produced without injury to the trees if the right kind of one is selected. It is not well to plant corn in a young orchard, as the stalks grow so large and high as to shade the trees too much. Either grass or grain will prove highly injurious. But potatoes, beans, or root crops, may be grown to good advantage.

In plowing the land, care must be taken not to bark the trees or break off their roots. There should be a good team, and a skilful man should hold the plow. Weeds ought to be kept down, and the surface soil should be kept fine and mellow. Manure ought to be spread upon the land every year and harrowed in. It is not well to put all the manure close to the body of the tree. The roots of a tree which is six inches in diameter often extend twenty feet from the trunk, and the great majority of the fibres which obtain the food are at least eight feet from the body. Consequently, spreading fertilizers close around the trunk can do but very little good. While the trees are small we pile a quantity of compost manure around the trunk of each tree late in the autumn. This keeps away the mice which would be glad to eat the bark. In the spring the manure is spread under the tree. In addition to this the crop which is grown upon the land should be liberally fertilized.

If the owner feels unable to continue the cultivation of trees after they become productive, the land can be seeded down to grass. When this is done, manure

should be applied as often as every other year, and the land should be plowed once in four or five years. But small trees ought not to be allowed to stand in grass or weeds. Many trees now bear poor and scabby specimens of fruit, and only a small quantity, which would yield a large and nice quality, and an abundant quantity, if the soil around their roots was properly stirred. No variety of fruit should be condemned as small or of inferior quality, while the tree producing the specimens which are tested stands in an unbroken sod. Some of the varieties which are of the highest excellence when the land is cultivated are absolutely worthless when this is neglected.

Pruning fruit trees is very simple and easy work, if it is taken in season, and properly performed; but if neglected too long, it becomes quite difficult, and its results are not always satisfactory.

If a tree is old, and its pruning has been neglected for many years, it will be necessary to cut away considerable of its top, in order to get it into a good form; but the indiscriminate cutting of young trees, which some men practice under the name of pruning, is very injurious, and often proves utterly ruinous to the trees upon which the operation is performed. When properly managed, no large branches need be taken from a tree.

The pruning should begin when the tree is set, and every spring the sprouts which are not wanted should be removed. For some years a sharp jack-knife will be large enough to do all the cutting that will be desirable. When the tree attains a larger size, pruning-shears and a fine saw will be needed. But there must be a constant watchfulness and an effort to keep down all shoots which are not wanted permanently on the tree. Many buds, which start out in places which ought to be vacant, can be rubbed off during the summer. Any one can see that the cutting off of a limb two or three inches in diameter involves a great waste of the vital forces of the tree. It often causes a wound which does not readily heal, and leads to premature decay. But if this evil is avoided, there is a waste of all the growth of the limb which is removed. If this growth had been wisely directed, it would have added to the size, strength and productiveness of the tree. When the bud first started, it could have been easily rubbed off. At the end of the first season of its growth, the shoot could have been clipped off with a knife. But after a few years it must be cut with a saw; all its growth is wasted; while its removal mutilates the tree and makes an ugly wound. It does not pay to grow trees in this manner. The formation of wood, which must be thrown away, should be prevented, and the growth of the tree directed to the securing of the desired shape and the utilization of all the vital forces.

If he commences when it is small, the owner of a tree can do a great deal toward determining its form when it is fully matured. He can decide whether the tree shall branch very low or very high, and whether the top shall be large or small. Many people think that the trunk of a tree increases in length as rapidly as it does in circumference. Acting upon this principle, they allow twigs, which in time will become the lower tier of branches, to start out only two or three feet from the ground. But the tree does not grow as they expected, and when the full size is reached, the branches are no farther from the ground than they were when the tree came from the nursery.

Whether it is desirable to have the trees branch high or low is a question which will be determined by the circumstances of each particular case. In localities where strong winds prevail, and where the weather is extremely cold, there are

certain advantages in having trees short and low. When the land is to be cultivated, the work can be more easily done if the trees branch some distance from the ground. It is inconvenient to get under a very low tree and still more difficult to prune, or pick the apples from, a very high one.

In pruning a tree, all the sprouts which incline to grow crooked, and those which interfere with limbs which are already established, should be cut out. The top should neither be very dense nor very open. If the branches are so thick that the sunlight cannot enter freely, the fruit will not ripen perfectly, and will not be as finely colored as it should be. If the top is too open, the branches are not protected as they should be from the severity of the winter winds, which dry the bark, and the burning of the summer sun, which scalds it. The common method of cutting all the twigs from large limbs almost their whole length, and "leaving a little brush on the end of the limb like a cow's tail" is extremely pernicious. By this means the limbs are exposed to the action of the elements, and there are not enough leaves left to fully elaborate the sap and keep the tree healthy and productive. Neither should the branches be wholly covered with twigs, as this would keep out the light and spoil the appearance of the tree.

If the pruning is attended to promptly, year by year, there will be but little difficulty in keeping the trees in good shape. If neglected, the owner must suffer the penalty which neglect always imposes. A little work at the right time will prevent the necessity of doing a great deal at some other time, and the results will be much more satisfactory.

THINNING FRUIT.

BUT few farmers are in the habit of thinning their fruit, and to this fact may be traced the imperfection of a great deal of the fruit and the irregularity with which the trees are fruitful. Too often the trees are heavily loaded one year and produce but very little fruit the next summer. During the bearing season, the vital forces of the trees are strained to their utmost in growing and ripening an excessive quantity of fruit. Nature does her best, but is not always able to carry out all that has been begun. Much of the fruit drops from the tree before it is fully formed, and a large part of what remains is only imperfectly developed and ripened.

But the partial failure to perfect the fruit is not the greatest evil which is involved in this over-production. The tree is so exhausted by its overload that it cannot recover at once. The wood which it has formed during the season cannot be thoroughly ripened and is frozen during the winter. The next spring but few blossoms are put forth and little or no fruit is formed during the summer. This is the natural result of over-bearing. If the trees are left to themselves the trouble becomes permanent. One year there is a great excess of fruit, while the next year there is an equally great scarcity.

The best, perhaps the only, remedy is to be found in thinning the fruit early in the season. It does no good to apply stimulating manures. This would be like pouring oil on a fire. The natural method of checking the evil is to commence as soon as the fruit is fairly set and pick off a large proportion of the specimens. It will not do to wait until the fruit is half grown, as the energies of the tree would then be seriously impaired. Some good would be done, but the remedy would be

applied too late to insure the best results. A few growers have tried the plan of whipping off the blossoms, but this is liable to permanently injure the bearing twigs. Others clip off the blossoms, or the small fruit, with pruning shears.

The only objection raised against thinning fruit is that it involves considerable work. But this really amounts to but little. The plan proposed merely changes the time of doing part of the labor, but tends to diminish rather than increase the amount. It is no more work to pick half the apples on a tree in June than it is in October. If picked early, and merely dropped upon the ground, the work can be done much faster than it can when all the specimens are to be saved. It is true that the farmer is usually more busy in the summer than he is in the fall, but, when they are overloaded, he can spend time enough to thin the fruit on his best trees, and he can hardly use the time to better advantage.

MR. JOSEPH HARRIS, whose opinions upon other subjects we have had occasion to quote, has given the farmers of this country a fine illustration of the advantages of thinning fruit. He has an orchard of Northern Spy trees, occupying four acres of land, from which he has sold more than twelve hundred dollars worth of apples in a single year. The trees were young and were expected to produce a much larger quantity when full grown. The apples were extremely large. One hundred and eighty-six specimens filled one barrel, and one hundred and ninety another. Many of the trees, though young and small, produced five barrels each. The large size was obtained by good cultivation of the trees reinforced by thorough thinning of the fruit. Early in the summer, one-half of the apples were picked from the trees. This gave the remainder an opportunity to grow, and the half which was left probably filled as many barrels as they all would have done if they had been allowed to remain. If the fruit had not been thinned, a large part of the specimens would have been small and many of them imperfect. The fruit which remained was probably worth twice as much as the whole would have been. Then, too, the benefit to the trees was very great. They were obliged to perfect only half as many seeds, and, consequently, required but comparatively little food from the soil. The growth of the seed does far more to exhaust both the tree and the land than the formation of all the other parts of the fruit. The large apple gets much of its food from the atmosphere, but the small one takes a much larger proportion from the soil.

As a barrel of large and finely-formed apples is worth, in almost any market, twice as much as an equal quantity of small and imperfect ones, the draft upon the vital forces of the tree and the elements of fertility in the soil is only half as great, and the labor of picking the fruit is less if part of it is taken off early in the season, there seems to be a fine opportunity for farmers to advance their interests and increase the profits of their orchards by thinning the fruit when the trees show an inclination to over-bear.

This applies not only to the production of apples, but, to a still greater extent, also to pears and peaches. Every year large quantities of peaches are thrown away after they have been transported to city markets, and still larger quantities are wasted at home. This involves a heavy loss, and is mainly caused by imperfect growth and ripening. If the fruit had been properly thinned, a large proportion of this loss would have been prevented. Pears often look pretty well, while their flavor is extremely poor. Sometimes they are badly formed and partially covered with scabs. These, and similar evils, are often due to a neglect to thin the fruit. In some cases, want of cultivation and care of the tree help make up the result, but, when trees are well cared for, neglect to thin the fruit is the principal cause of its imperfection.

GATHERING FRUIT.

WARE in gathering the crop is one of the essentials of success in fruit-growing. Many farmers obtain good fruit in the autumn who do not succeed in keeping it through the winter. The most perfect method of growing fruit will give only temporary benefit if the gathering is carelessly done. If the fruit is not picked at the right time, or if it is bruised or imperfectly sorted, it will not keep well, and will not command the highest market price. A great deal of fine fruit is injured every season by bad handling, and by storage in improper places, and with imperfect specimens.

The time for picking fruit depends very much upon the variety and the purpose for which it is to be used. Fruit which is designed for long keeping should be picked earlier than that which is to be used at once. A great deal of the summer and autumn fruit which is sold in the city markets is not well ripened on the trees, but is picked while green in order that it may be enabled to bear transportation. By this means the desired end is secured, but the flavor of the fruit is seriously impaired. An apple which is picked while hard enough to be safely transported to market, has a very different flavor from one, which was originally no better, which is allowed to remain on the tree until it is mellow.

Fruit which is to be sold, and winter fruit for long keeping, should be picked when quite hard. For family use apples of the early varieties should hang upon the trees until they change color perceptibly, and begin to grow mellow. With the exception of a very few varieties pears are better to be picked from the trees before they are fully ripe. When careful raising of the fruit causes the free separation of the stem from the twig upon which it grew, the best time for gathering has arrived. A few varieties will bear still earlier picking, but nearly all kinds will be better to remain until this time, and some will utterly spoil if gathered earlier. It is not always safe to allow pears to remain on the trees as advised for early apples, as many varieties will rot at the core if left to fully ripen on the trees.

All kinds of fruit should be gathered before very hard frosts. Winter pears will safely endure a greater degree of cold than apples, but they should not be too much exposed.

When the winter fruit is sufficiently matured, the gathering should be performed as rapidly as possible. The work should only be done in good weather, or, if the fruit is gathered when wet, it should be carefully dried before being put into winter-quarters. The picking should be done by hand, and the greatest care ought to be taken not to bruise the fruit even in the slightest degree. A sack hung over the shoulder, and its mouth kept open by means of a hoop or a stick, is very much better than a basket. Each specimen must be carefully *laid* into the sack or basket, and not dropped even for the shortest distance. Some apples bruise very easily, and when dropped two or three inches upon other specimens, will surely be injured. Sometimes the bruises are so slight as to escape notice at the time, but after the apples have been picked a few days, and fermentation has set in, they become plainly visible. These little bruises cause the premature decay of a large quantity of hand-picked fruit.

If apples are picked into a basket they must not be turned out but carefully removed by hand. If a sack is used they can, if sufficient care is taken, be turned into a barrel or upon a pile. It is a good plan to spread the apples on the floor of

a store-room or the barn, and allow them to "sweat" for a few days or weeks before they are put away for the winter. This adds greatly to the keeping quality of the fruit, and, what is still more important, furnishes an opportunity for a more careful selection and grading than would otherwise be secured.

When apples are put into barrels as soon as they are picked from the trees, some imperfect specimens are almost sure to find their way into the company of the best fruit. These defective apples soon decay, and cause the early destruction of the better ones with which they have been in contact. The loss of the imperfect fruit is small when compared with the injury done to that which was good when the barrels were filled. Some growers prefer to pile the fruit on the ground instead of under cover. If the room is well ventilated, and the door kept open during the day, there can be no harm in having the apples on the floor, and in case of storms they will be better protected than they can be if left out of doors.

Before the weather becomes cold enough to injure them the apples should be carried into the cellar or fruit-room in which they are to be kept. Whatever the condition in which they were when gathered from the trees they must be perfectly dry when put into the barrels. The presence of dew or rain will be fatal to their keeping qualities. It is also important to carefully assort the fruit. The riper specimens, which may be easily detected by the change in their color and by indications of early mellowing, should be placed in different barrels from those which are hard and not fully mature. Large and small ones should be put into separate packages. The presence of a small proportion of small apples in a barrel of large ones will add but very little to the measure, but will take considerable from the price. Eight barrels of large apples will bring more money than ten barrels of large and small ones, although in the whole lot there may not be more than a single barrel of inferior specimens. When the fruit is placed in barrels, care must be taken not to bruise it. Slight bruises which do not break the skin cause speedy decay, while the larger ones start the process of fermentation still sooner.

If the fruit is to be sold, the barrels should be gently shaken occasionally while being filled. The head should be pressed in by a lever and securely fastened. It is not safe to omit this pressure, as the fruit will then shake in the barrels, and be badly bruised while being transported. If properly pressed, the fruit cannot move and will go safely any required distance.

If the fruit is to be used at home, it should be gathered and assorted with as much care as though it were to be shipped, but the barrels need not be headed. If this plan were followed, the complaints which farmers so often make, that their apples do not keep well, would not be so commonly heard, and the frequent "picking over" of the apples to get out those which are partially decayed could be abandoned. If proper care is used in gathering and packing, and the cellar is fairly good, the best apples will keep a long time without showing signs of decay. But if large and small, ripe and unripe, perfect and imperfect, specimens are mixed together there will very soon be decayed apples in the barrels, and all the fruit must be sorted over in order to remove those which are spoiled, and are doing all they can to spoil those with which they are in contact.

DRYING FRUIT.

IT has long been a common custom in all the fruit-growing sections to dry part of the fruit produced on the farm. Windfall apples, and those which showed signs of early decay, peaches, and other fruits have been dried in order to prevent loss to the owner, and preserve, as far as possible, the good qualities of the fruit. Berries have also been dried in immense quantities, and thus kept for an indefinite period.

But the old-fashioned process of drying did not prove wholly satisfactory. It required considerable time, and involved a great amount of labor; and it did not fully answer the purpose for which it was designed. It secured the preservation of the

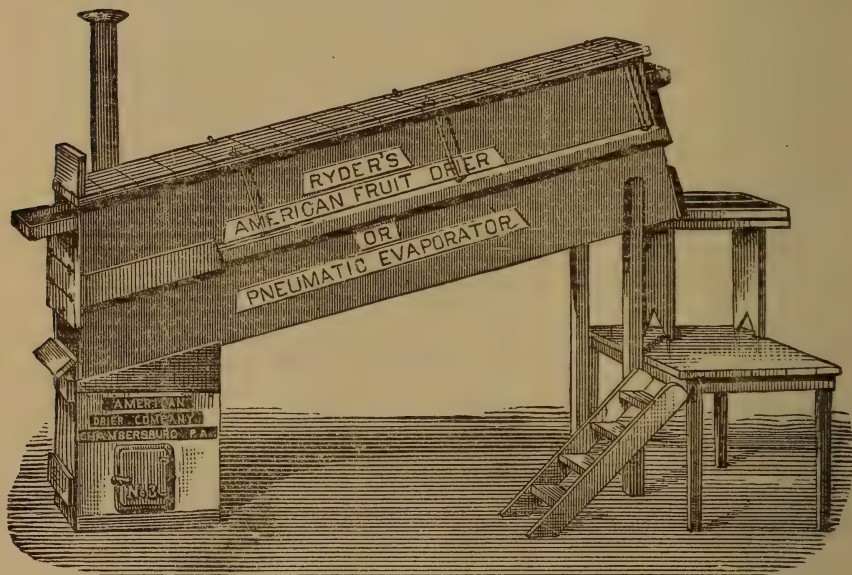


FIG. 118.

fruit, but did not keep its quality unimpaired. In too many cases the drying was about as injurious as the decay which it prevented would have been. The quality of much of the dried fruit found in farm-houses and in market is extremely poor.

In order to prevent the deterioration in the quality of fruit, which seemed inseparable from the common method of drying, many farmers and fruit-growers have tried the plan of canning fruit which they wished to preserve. This is a great improvement, but it involves a great deal of labor and considerable expense. Besides, the results are not always good. Many cans leak, many glass jars do not seal tightly, and the contents are spoiled. The addition of quite a quantity of sugar is also required, and it is necessary to at least partially cook the fruit.

What has long been needed is a process which should fully preserve the fruit in its natural state (*i. e.*, without cooking), and without the addition of foreign material. This need seems now to be fully supplied. Several machines for evaporating fruit

have been brought before the public. One of the very best of these is represented by Figure 118.

In this machine the moisture of the fruit is quickly removed by currents of dry, hot air. The cell structure of the fruit is preserved unbroken, and there is no cooking, over-heating, or partial decomposition, as there always is when fruit is dried in a common oven or in the sunlight. The fine flavor of the fruit is fully retained. Nothing but water is removed, and the addition of water restores the fruit to its original condition in size and appearance, makes it as tender as fresh fruit, and seems to increase its sweetness.

After being dried in one of these evaporators, the weight of a bushel of apples is only six and one-half pounds, and one hundred quarts of blackberries weigh only forty pounds. Fruits, which have been cured in this manner, can be preserved as long as desired, and their quality will remain unimpaired. There is no cost for sugar, cans or jars, but the fruit can be packed in boxes, or paper bags, and kept until wanted for use.

The introduction of this method of preservation will give a great impetus to the business of fruit production. Not only are several stock companies now doing a large business, representing several millions of dollars per year, in drying fruits, but the way is now open for farmers to profitably dispose of all the fruit which they can produce. If there seems to be an over-production in the fall, and fruit in its natural state will not find a ready sale, the surplus can be quickly and cheaply evaporated, and thus put into a condition in which it will be wanted in market, and will command prices which will be satisfactory.

DISEASES AND ENEMIES.

LIKE all other things of value, fruit trees have their enemies, and are subject to various evils. In some localities they are more exposed to injuries than they are in others, and some varieties, which are perfectly hardy in some sections, are tender and exposed to disease in other parts of the country. There are plenty of fruits which are adapted to the various degrees of temperature, and where one variety fails, another can be substituted, and made to thrive. But there should be no wholesale change until all reasonable efforts have been made to check the disease, or drive off the insects, and get the trees already in the field into a healthy condition.

Good cultivation, which tends to promote a vigorous growth and development of the trees, does very much to ward off disease, and enable the vital forces to resist the attacks of insects, which otherwise might prove very destructive. Some diseases can be checked by proper treatment, and some classes of insects can be driven away.

One of the most serious diseases which attack fruit trees is known by the name of BLIGHT. This attacks the pear, apple and quince, but proves the most destructive with the former. The effect of this disease is to wither and blacken the leaves on some of the most rapidly-growing branches. Sometimes this spreads over the entire tree, and all the leaves fall off in mid-summer. In many cases the evil affects not merely the leaves, but the branches upon which they grew. The ends of the affected limbs perish, and the fatal affection rapidly extends toward the trunk.

If left to itself, the whole tree is very soon destroyed. The remedy is simple, but must be applied quickly, and with an unsparing hand. Delay, even for a few days, endangers the life of the tree. All the affected branches should be cut off two or three feet below the point at which there is an external manifestation of the disease. These limbs should be immediately burned. If the branches are not cut quite a distance below the point which seems to be the limit of the disease, the poison will not all be removed and the evil will not be eradicated. The disease may spread when prompt measures are taken for its suppression, but it can usually be checked. If, after the removal of diseased portions, other branches are affected, they must also be removed, and the pruning must be kept up until the disease is checked, or the whole tree is destroyed. If the attack is sudden and malignant, and appears to involve the whole tree, the axe had better be laid at the roots, and the whole committed to the flames. Delay, or half-way measures, will cause the rapid spread of the disease, and the loss of many, if not all, of the trees in the immediate vicinity.

There is another disease, known as *LEAF BLIGHT*, which attacks pear trees, and for which no certain remedy is known. The leaves turn black, and fall from the tree, and all growth is checked. It is more liable to attack small trees than large ones, though both the leaves and fruit of full-grown trees are sometimes affected.

By keeping the soil rich, and giving good cultivation, the grower should endeavor to prevent the appearance of this disease.

In its attacks upon the apple and quince, the blight does not prove as destructive as it does with the pear, but in some portions of the WEST, apple trees are often severely injured from this cause. The disease affects the growth of the season in which it appears, and causes the falling of the leaves and death of the diseased wood.

THE *BLACK KNOT* is a disease which attacks plum and cherry trees, and occasionally the peach. An irregular swelling appears on the affected twig and limb. It commences early in the summer, and grows until the end of July. Year by year it becomes larger and more poisonous until the life of the tree is destroyed. The disease also spreads to surrounding trees. The remedy consists in promptly cutting away all diseased limbs a few inches below the point reached by the disease. If the excrescences appear on the trunk or large limbs, they should be cut out, and the wound washed with a solution of chloride of lime. Every particle of the diseased wood must be removed, or the labor will be in vain.

THE *YELLOW*s is a disease which attacks the peach and often proves very destructive. It causes a premature ripening of the fruit, with discoloration of the flesh, and a yellow appearance of the leaves. The diseased trees seem to be filled with poison, and the knife used in pruning them will carry it to those which are healthy. The disease also spreads without actual contact, and sometimes destroys whole orchards. No cure is known. The diseased trees should be cut and burned as soon as they appear to be affected. No trees should be set in the places recently occupied by the diseased ones, as the poison would rapidly spread from the roots.

MILDEW is a disease which attacks both the grape and the gooseberry, and, to a limited extent, the peach. It attacks the foreign varieties of the grape when the vines are grown in the open air, and several of our native varieties are affected in unfavorable seasons. As soon as the disease appears, the vines should be dusted with sulphur, and this treatment repeated every fortnight as long as it is needed. When hardy varieties are planted far enough apart, the branches properly thinned, and good culture is given, there will be little trouble from this source.

This disease affects the gooseberry still more seriously than it does the grape. It is due, in a great measure, to climatic influences, but may be modified by pruning and good cultivation. Mulching heavily in the spring with salt hay is said to be an efficient remedy.

When peach trees are attacked by mildew, soap-suds should be thrown over them with a fountain-pump. The addition of lime-water to the soap-suds, and the subsequent dusting of the trees with sulphur, is also highly recommended by growers who have had considerable experience with the disease.

There are other diseases which result from neglect, and some which are subject to climatic changes. These, and the ones we have named, can be much more readily prevented than cured. If no diseased tree is allowed in the vicinity, no grafts or buds from affected trees are used, and all contagion by means of the pruning-knife is avoided, it is almost always possible by giving good cultivation, constant care, and suitable pruning, to keep the trees healthy and vigorous. In buying trees, care should be taken to obtain the most healthy and hardy varieties, and to get trees which have not been exposed to the contagious influence of any form of disease.

THE TREES AND FRUIT ARE BOTH EXPOSED to the attacks of several enemies which, if allowed to remain unmolested, would soon destroy them. Among these enemies the various insect tribes prove the most formidable. They not only do an immense amount of mischief, but they are very difficult to dislodge or destroy.

THE CURCULIO is a small but very destructive insect which attacks the plum, apricot, cherry, apple, and some other fruits. When the fruit is very small, the insect makes a crescent-shaped puncture and deposits an egg. The egg soon hatches, and the larvæ work their way to the centre of the fruit. After a few weeks, the injured specimens fall to the ground, the insect passes into the earth, and is changed to the perfect beetle which lays eggs and thus provides for a continuance of its race. This insect makes its appearance nearly every year, and, unless measures are taken to prevent its depredations, it will destroy almost the entire crop of plums and quite a proportion of the cherries. Sometimes it takes every plum from a fruitful tree. There are a few very thick-skinned varieties which partially resist its attacks, but the finest kinds fall an easy prey to its destructive efforts.

Although very rapacious if let alone, the curculio can be more easily destroyed than some other enemies with which the fruit-grower is obliged to contend. Two methods are in common use. One aims at the destruction, the other at the driving away of the insects. The former gives the best results. The best way is to shake the insects down upon sheets spread under the trees, and then destroy all that fall. In the morning these insects are very sluggish, and can be easily captured. The tree should be jarred suddenly. This will bring down twice as many insects as an ordinary shaking. Saw off a limb an inch or two from the trunk, and upon the projection thus formed strike with a hammer. For large trees a sledge may be required. The work should be commenced as soon as the fruit sets, performed every morning, and continued until the time for ripening. If any specimens of fruit fall to the ground, they should be removed at once and fed to the pigs or otherwise destroyed.

The other class of remedies has for its object the driving away of the insects. For this purpose, fine coal-ashes have been highly recommended, and have often been effective. The trees should be dusted two or three times a week from the time the blossoms fall until the fruit is ripe.

THE CATERPILLAR, of which there are several species, is one of the most destruc-

tive enemies of the apple tree. It feeds upon the leaves, and often makes large trees wholly unfruitful. As the leaves are "the lungs of the tree," it naturally follows that the removal of any considerable portion of them must be very injurious. It will check the growth of the tree, and cause the fruit to wither, and fall prematurely to the ground.

The common **TENT-CATERPILLAR** is hatched at the time the leaf buds open in spring, and gradually increases in size until it is two inches long. After reaching its full size, meanwhile voraciously eating the leaves, it "spins a cocoon and passes into the pupa state. In the latter part of summer it comes out a yellowish brown miller," lays a large number of eggs, in rings around, and near the ends of the smaller branches, and then dies. These eggs hatch out the next spring, and each collection makes a nest of caterpillars which is capable of destroying the leaves and injuring the fruit of a large branch. The best way to fight these enemies is to clip off the branches upon which their eggs are deposited, and burn them. This can be done during the winter, or when the eggs are hatching in spring, but should not be delayed until the insects are grown and commence their work. If any are overlooked, the caterpillars should be brushed off and destroyed.

THE **FALL WEB WORM** is another destructive caterpillar which attacks many different kinds of trees. The eggs are "deposited on the under side of a leaf, near the end of a twig. These soon hatch, and the larvæ commence feeding on the upper surface, spinning their threads from side to side, and then, attaching two or three leaves together, they soon make a web. They continue feeding and spinning along the twig as they consume the tender portion of the leaf, leaving the mere skeleton." These caterpillars are small, pale yellow, with a broad, dark-colored stripe on the back, and another beneath, thickly covered with white hair, and have black heads and feet. They appear in OHIO at the end of May, and continue until OCTOBER. They not only attack fruit, but also forest trees. The methods of destruction are the same as recommended for the tent-caterpillars.

THE **CANKER WORM** attacks both fruit and leaves, and often proves very destructive. The female is nearly destitute of wings, and fruit-growers take advantage of this fact to keep her from the trees. A cloth band coated with tar, printing ink, or a mixture of tar and oil, is fastened around the trunk of the tree. The mixture needs to be applied frequently, as it gets dry in a few days or weeks. It should not be applied directly to the tree, as it will prove injurious. The insects cannot pass the belt, but stick to its moist surface, and will soon perish or can be easily destroyed. "**TREE INK**," manufactured by GEORGE H. MORRILL & Co., of BOSTON, MASS., has been extensively and successfully used for a dozen years as a "canker-worm exterminator," and is, probably, the best thing for the purpose which has yet been devised. In using this a band of tarred paper six inches wide should be securely fastened around the trunk of the tree about four feet above the ground. This is saturated thoroughly with the **EXTERMINATOR**. The application can be made with a paint brush, and should be repeated before the band gets dry. Only a few applications will be required during the season. Tin bands with the outer edges turned downwards are sometimes used, and shallow vessels filled with oil have been successfully tried. The moth attempts to ascend the tree, for the purpose of laying her eggs, in the mild days of winter and early in the spring. Sometimes the moths commence in the autumn. Consequently preventive measures must be taken promptly and kept up for a long time. It is very much easier and better to keep the moths from ascending the trees than it is to fight the canker worms after

they have taken possession. Still if the worms make their appearance they should be dislodged as soon as possible.

THE CHERRY SLUG often injures cherry and pear trees, and prevents the ripening of their fruit. This creature is "about half an inch long, and of a dark, greenish brown when filled with food. Its smooth, shining, and jelly-like skin, and snail-like appearance have given it the name" of slug. It can be driven away by dusting the trees with dry ashes daily, while the leaves are wet with dew.

THE APPLE WORM (the insect parents known as the "codling moth") often proves very destructive to this variety of fruit. It enters at the blossom, and feeds at the core of the fruit, causing much of it to fall prematurely, and seriously injuring much that remains upon the tree. MR. THOMAS says "the best preventive is to allow swine or sheep to pick up the wormy fruit as it falls, thus destroying the enclosed insect, and preventing its spread." By rubbing the trunks with a piece of liver, the sheep can be kept from gnawing the bark of the trees.

THE ROSE BUG often eats the flowers and leaves of the apple and grape, as well as the rose. When this pest comes in large numbers, as it does in some seasons, it does a great deal of damage. When rose bugs attack the grape flowers they should be picked off and destroyed. The work should be done early in the morning, and must not be given up until the enemy disappears. When small apple trees are attacked, the insects may be caught by placing basins or pails containing water underneath, and then jarring the limbs. When the work of destroying them is commenced early, and performed with care and vigor, these pests will be disposed of in a short time. But it will not do to allow them to take their own course, and then expect to obtain a fair crop of grapes or a large yield of apples. If the fruit is wanted, the enemies must be destroyed.

THE CURRANT WORM eats the leaves of the currant and gooseberry, sometimes entirely stripping the bushes in a few days' time. The removal of the leaves prevents the ripening of the fruit, and also injures the bushes. Powdered white hellebore is a certain remedy. As soon as the worms appear this should be applied. If used dry a small quantity should be dusted upon the leaves, from a dredging-box with fine openings, when they are wet with dew. A better way, as there is less danger that the operator will inhale the dust, is to dissolve a tablespoonful of the poison in a pailful of water, and sprinkle the bushes with the mixture. The bushes must be closely watched, as these pests often come in great numbers, and sometimes devour all the leaves before their presence is suspected. After the first brood has been destroyed another may appear. If it comes the same course must be pursued.

APHIDES, or plant-lice, of various kinds, often take up their abode upon the leaves of fruit trees and cause severe injury. We have seen a cherry tree which was large enough to produce a bushel of fine fruit kept from bearing for several years by these minute enemies. Soon after the blossoms appeared the leaves began to curl, the growth of the tree was retarded, and the formation of the fruit was checked. Upon the under side of the leaves multitudes of black lice were located, and, by sucking the juices, they caused the leaves to curl and the fruit to perish. Throwing a solution of whale-oil soap over the tree will prove an efficient remedy. For this purpose a fountain-pump, or large syringe, is needed. The liquid must not be too strong, as then it would injure the leaves as well as kill the lice. A test should be made upon a single branch in order to determine the quantity required. The application should be made in the evening, and repeated as often as necessary.

THE APPLE-BARK LOUSE attacks the smooth bark of apple trees, and, in connection

with other evils, often proves fatal. Of this insect, DR. FITCH says: "It makes its appearance as a little brown scale, one-eighth of an inch long, the shape of an oyster-shell, fixed to the smooth bark, resembling a little blister. This scale is the dried remains of the body of the female, covering and protecting her eggs, from a dozen to a hundred of which lie in the cavity under each scale. These eggs hatch the latter part of May, and the young lice diffuse themselves over the bark, appearing as minute white atoms, almost invisible to the eye. They puncture the bark, and suck the sap from it." For treatment, a mixture of equal parts of tar and linseed oil applied to the bark warm, but not hot, early in the spring, has proved very useful. MR. THOMAS says: "Scraping and scrubbing, in summer, with a stiff brush, in soap-suds are useful. Thriftiness from good culture is the best preventive, and trees badly affected should be cut up and burned."

THE BORER is a dangerous enemy of the apple, quince, and some other trees. It enters the tree near the ground, cuts its way through the wood in various directions, and seriously, often fatally, injures it. The eggs are laid under the loose scales of the bark, and the insects which are hatched from them eat through the bark when quite small. They remain under the bark, and feed upon it, for several months. When they are about half grown they work their way into the wood. Their presence, even in the early stages of their attack, may be detected by the powder which comes out of the bark where they are at work. If taken in season, the insect may be cut out with a sharp-pointed knife, but, after it has passed into the wood, a sharp, flexible wire should be pushed into the hole which it has made and the intruder crushed, if possible. This effort is not always successful, as the channels are often very crooked. The trees should be examined frequently, from early in the spring until autumn, and, when there are any indications observable of the presence of borers, they should receive immediate attention. It is better to cut the tree to quite an extent, if the borers cannot otherwise be destroyed, than it is to allow them to continue their work. But, if taken in season, only a little cutting will be required.

There is also a worm, or grub, which attacks the peach tree. It enters the bark just below the surface of the ground, but does not go far into the wood. It can easily be found by means of the dust and gum which issue from the cavity which it makes. The dirt should be scraped away, and the intruder destroyed with a sharp knife. Every tree should be examined early in the spring and in the summer. If a little heap of ashes, air-slaked lime, or earth, is formed around the trunk early in the season, or the trunk is encased with pasteboard or some similar substance, the enemy will be kept entirely away.

MICE often prove terribly destructive to young trees, and many apple orchards have been almost wholly destroyed in a single season. Their method of operation is to gnaw the bark from the trunk of the tree, often completely girdling it and causing its death. They frequently work under the snow, but sometimes go from tree to tree on the crust formed by the freezing of rain on top of the snow. When trees stand in the turf, and long grass is left around them in the fall, the mice often take refuge in and make their nests out of it. The best way of protecting trees, one which we have tested many years with unvarying success, is to make a mound of compost manure, a foot or more in height, around the trunks late in the autumn. This is packed closely around the stems, and, when the mice travel on the ground, proves an effectual barrier. No strawy material should be used, as this would not pack closely enough, and the mice would use it for their nests. Soon after the

snow is gone in the spring we spread the manure under the trees, and thus make it perform an additional service in promoting the growth and fruitfulness of the trees which it has protected during the winter.

Many farmers go among their trees after each snow-storm and tramp down the snow as closely as possible around the trunks. If this is faithfully performed it answers the purpose very well, but it requires considerable time and is liable to be forgotten.

RABBITS prove very dangerous enemies to trees in some localities, working in the same manner, but much more extensively than mice. We have known tame rabbits to seriously injure a fine orchard before their owner had any idea that they were in mischief. But the greatest injury is caused by those which have not been domesticated. A fruit-grower in a section in which these animals abound, says, that if one is killed, and his flesh and blood rubbed over the trunks of the trees, the others will let them entirely alone. This treatment should be repeated every few weeks, and the trees carefully watched to see that it proves efficient. When this method does not seem practicable, the trunks of the trees should be rubbed with a piece of fresh liver. This should be done once in every two or three weeks. Encasing the trunks with tin—old tin pans can be made to furnish part of the material—or with stiff paste-board, is a still more certain protection.

SHEEP and lambs often gnaw the bark of apple and pear trees when they find access to them. Rubbing the trunks with liver, as recommended for keeping rabbits away, is a very good preventive. A board box around the trunk, to be kept on only as long as the sheep are in the orchard, would be a still better method of protection. Fencing around each tree would also prove beneficial, and is the method which we have followed for many years. But this method cuts off, in a great measure, the main advantage which is to be secured from the pasturing of sheep in orchards of small trees. The great benefit of keeping sheep among fruit trees comes from their eating the immature specimens which fall to the ground, and thus destroying the insects which spoiled the fruit. But, if fences are built around the trunks so as to keep sheep from the bark, they must either be very closely boarded or else must be quite a little distance from the trees, and allow considerable fruit to fall between the fences and trees where the sheep cannot get it.

CATTLE often prove very destructive when allowed to feed in an orchard. They bite off the ends of the limbs of young trees, and use the trunks for rubbing-posts so effectively as to loosen the roots and break the stems or the lower branches. Consequently they should never be allowed to run in an orchard.

Concerning both diseases and enemies, the wise fruit-grower will always act upon the principle that prevention is a great deal better than cure. Many of the diseases and accidents to which trees are liable can be easily prevented, but can never be cured. Others, which are not necessarily fatal, retard the growth of the tree, or prevent the ripening of the fruit, and thus make it impossible for the owner to obtain a fair compensation for his time and labor. If properly managed, fruit may be made one of the best paying crops which the farmer can produce; but if the trees are neglected, they will soon fall a prey to the evils to which they are exposed, and the owner will often come to his orchard "seeking fruit, but finding none."

PROPAGATION.



ALTHOUGH there are several different forms, there are but two radically different methods of propagating trees and plants. These methods are by seeds, which is a natural process, and by buds, which, in the case of most trees and many plants, is an artificial method. Fruit trees are often started from the seed, but afterwards modified by buds from other trees. A bud is more fully developed than a seed, and is more certain to possess the characteristics of the parent. An apple seed will not often produce fruit like the specimen from which it is taken, but a bud from any given tree will yield fruit closely resembling that of the parent. Consequently, for all farm purposes, the propagation of varieties of trees and small fruit plants should be mainly by means of buds in preference to the use of seeds.

The various processes of budding and grafting trees, and the methods of propagating plants and vines, can be easily described, but as MR. ELLIOTT, in his *HANDBOOK FOR FRUIT-GROWERS*, has said, it is best for the "beginner to visit a leading nursery-man or amateur fruit-grower in his immediate neighborhood, where he can learn more in half a day of observation than all of what is printed."

The principal methods which are to be used on the farm for the propagation of small fruits and vines are by the use of CUTTINGS, LAYERS and RUNNERS. For the propagation of specific varieties of the larger fruits, BUDDING and GRAFTING. All these methods require the use of buds.

Cuttings, for out-door use, are to be made, in the autumn, of the growth of the previous season. A little of the older wood is often left upon the lower end of the cutting. This method is used in propagating the grape and many other plants and vines. The cuttings should be made by severing the cane immediately below the lower bud, and from one-fourth to one and one-fourth inches above the upper bud. These pieces are often left a foot and a half long, but those having only three buds are much better. Some prefer only two buds, and when vines are specially valuable, single bud-cuttings are often used. They should be made from well-ripened wood. If not secured in the fall, they can be taken from the vine at any time, except in freezing weather, before the buds swell in the spring. But it is the best way to cut them between the falling of the leaf and the coming of winter, and pack them in moist sawdust, or moss, in a cellar, or else bury them in the ground. If kept in a cellar, they should be secured from the attacks of mice, and if buried in the ground, they should be put in a dry place.

The following directions, by a well-known horticultural writer, for setting cuttings are as good as can be given: "Take a spade, and open a place anywhere in your garden as deep as the cuttings are long, leaning the side against which the cuttings are to be set on a slight slant or angle. You then set them with the upper bud of each even with the surface of the ground when smoothed off, or as nearly even as you can, it making no very great difference if some of the buds are above the level of the ground. When you have thus set the cuttings along the slanting side of the excavation, and about six inches apart, then fill in the soil around the lower buds half way to the top of the cuttings, and then with your foot, stamp the earth against the bottom buds as compactly as you can; then fill up and stamp again, not perpendicularly, but against the cuttings as they stand on an angle. They may be set at any time in April or May, but always soon after being received. Probably ten out

of twelve will grow, and make good vines by fall. They do not generally take root, and grow freely till the last of June, in the latitude of NEW JERSEY. I generally protect the buds from the heat of the sun, which sometimes kills them before the roots start, by placing a board on the sunny side on its edge, slanting a little over the cuttings, so that they will have shelter from eleven A. M. to four P. M. Water them in a drought once or twice a week, thoroughly, and you will be sure to meet with success."

Some plants are more easily propagated by means of cuttings from the roots than they are from buds growing on the wood. The kinds which throw up sprouts from the roots belong to this class. The BLACKBERRY and RED RASPBERRY are examples. The PLUM, PEAR, and CHERRY trees can be grown in the same way, but the fruit of the new plants may not be like that of the parents. The method of obtaining these cuttings is very simple. Take up the roots and cut them in pieces from two to four inches in length. Plant these pieces in drills, covering them from one-half inch to one inch in depth. Buds will soon be developed, and nearly every piece of root will form a plant.

Layers furnish an easy and very successful method of propagating the plants to which it is adapted. The GRAPE, QUINCE, and RED RASPBERRY are common examples of this class. This is a more certain method than propagation by cuttings, and if not carried to excess does not injure the parent plant. It is best to put down only one or two canes of a strong grape vine, and but part of the shoots of other plants, and allow the remainder to grow in the natural manner. When the buds begin to start in the spring, grape vines should be put down. If only one new plant is wanted, all that will be necessary with most varieties is to bend down a strong shoot into a hole in the ground, fasten it with a peg, and cover it to the depth of a few inches with fine soil. Figure 119 represents this method of propagation. The end of the shoot may be cut back to one strong bud, which should be left out of the ground to form the stalk of the new plant.



FIG. 119.—LAYER.



FIG. 120.—SPROUTS FROM LAYERED CANE.

A few varieties do not form roots readily. In these cases "tongueing" is resorted to. "This is simply cutting into the cane or branch where it is bent down into the ground, and making a slit forward through the centre for an inch or two. The cut is usually commenced just below a bud, and may be above, below, or at the side." When this is done, fasten down the vine and cover with earth. Sometimes slightly twisting the branch where it is bent in the ground will answer every purpose. When several plants are wanted choose a strong cane which starts near the ground, dig a narrow trench six inches deep, lay in the cane, and fasten it with wooden pegs. When the buds have grown a few inches fill the trench with fine earth. This will cause a plant to grow from each bud on the cane, as shown in Figure 120. Some

growers do not wait for the buds to start, but fill the trench at once. When RASPBERRY and similar plants are to be propagated by layering, the work is not commenced until the tips of the plants grow nearly free from leaves and are of a dark purple color. This will be in August or September. Then cover the top of the canes in trenches, three or four inches deep, dug at an angle of forty-five degrees. In a few weeks there will be plenty of roots, and the plants can be taken up. The canes should be cut off about six inches above the new roots.

With some plants, like the strawberry, propagation by RUNNERS is a natural process which the grower often has occasion to check rather than encourage. When plants are to be obtained in this manner, the ground between the rows should be kept mellow. If the new plants are wanted to occupy certain positions, so as to form other rows, the end of the runner should be placed where the plant is to stand and covered with a little dirt. In six or eight weeks the plant will be well rooted, and the runner should be cut off.

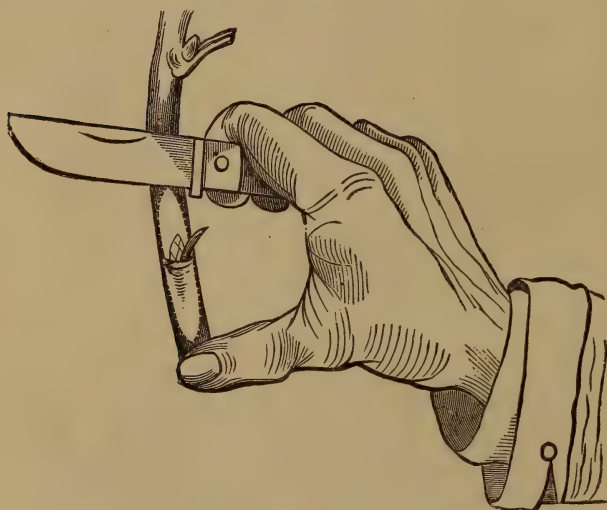


FIG. 121.—CUTTING A BUD.



FIG. 122.—PREPARED STOCK AND BUD.

BUDDING is the method which is in the most common use for propagating particular varieties of the larger fruits. It can be done easily and rapidly, the new shoots are very likely to grow, and by its means the rapid multiplication of trees of any special variety can be effected. Budding can be done when the trees are only a year or two old, or small branches of full-grown trees can be subjected to this operation. Nurserymen do this work when the trees are quite small. The best time for budding is in mid-summer. The stock in which the bud is placed should be growing in order that the bark may slip, and the new growth which is to be used for propagation must be sufficiently advanced to have plump and well-matured buds. The method is described as follows by Mr. Jenkins, a well-known nurseryman of Winona, Ohio, in his valuable work on the "Art of Propagation:" "A transverse cut is made at a smooth spot on the stock, and a perpendicular slit downward from this for a distance of one or two inches. The corners of the bark being slightly elevated with the point of the knife. The operator then takes the stick of buds, and entering the knife above brings it out one-half an inch below the bud or eye. A

little wedge of wood is thus cut out with the bud and bark, the removal of which is advised by some nurserymen, but as it does not seem to interfere at all with the uniting of the tissues, and the removal is tedious and fraught with some danger to the eye of the bud, it is usually omitted. Into the cut previously made in the stock the bud is now inserted and pressed downward under the bark, then tied by passing strings of bass matting or cotton yarn around the stock, thus pressing the bark closely over the bud; care must be used not to allow the ligature to rest on the eye of the inserted bud." In ten days the ties should be cut at the back of the stock. If the bud is not fully united to the stock, it must be tied as before and left until the union is complete. The next spring the stock should be cut off (if the tree is small; or the branch, if the tree is large) an inch or two above the point of insertion. All the sprouts which start upon the stock must be rubbed off so that the growth may all be utilized by the bud. Figure 121 shows the method of cutting a bud. Figure 122 shows both the stock and bud after they are prepared.

A little practice will enable any one of ordinary dexterity to perform the operation of budding rapidly and successfully. The beginner should remember that the incision in the bark of the stock is to be formed nearly like the letter T, that only perfectly formed and fairly matured buds should be used, and that the buds must neither be wet with water, nor exposed to the drying wind or sunlight. As soon as they are cut from the tree all leaves should be removed from twigs from which buds are to be taken.

RING BUDDING consists in taking off a ring of bark, quarter of an inch wide, from the stock, and in the place which it occupied inserting a similar ring containing the bud which it is desired to have grow. For ordinary use it is not better than the method above described, but is said to be more successful in the budding of hard wood trees, and of the grape vine.

GRAFTING is a method of propagation largely used by nurserymen, and is applicable to trees of all sizes as well as to the roots of small trees.

There are several different ways of performing the operation. The best ones for use on the farm are whip-grafting for small trees and cleft-grafting for those of larger growth. In the former method the stock and scion, which should be of the same size, are shaved to a like angle, fitted, as shown in Figure 123, so that they will lock together, and then bound or tied as directed for budding. Cleft-grafting is practised when the stock is much larger than the scion, and is used when trees of



FIG. 123.—
WHIP-
GRAFTING.

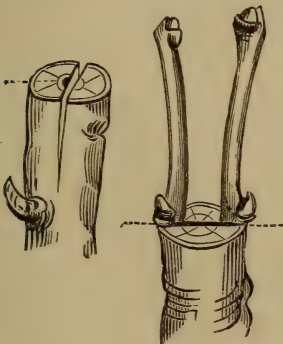


FIG. 124.—CLEFT-GRAFTING.

considerable size are to be grafted. The stock should be cut off with a fine saw, square across, split in the middle; and two scions, the lower ends of which have been shaved in the form of a wedge, are inserted in the crack. Figure 124 shows the method of preparing the stock, and how to set the scions. Some operators set the scions nearly straight, while others slant them considerably. The former is the

best way if skilfully done, but the latter is surer when carelessly performed. The point to be gained is to have the inner bark of the scion exactly meet the inner bark of the stock. If the scions are set nearly straight the bark upon the two pieces may be made to join for quite a little distance, but if care is not used they may not meet at all. But if the scions are set at an angle, there will be a spot where the inner bark of each will come in contact. After the scions are set, the end of the limb, and the sides as far as it was split, should be well covered with grafting wax. This may be made of equal parts of rosin, bees-wax, and tallow. These articles are to be melted together, and thoroughly mixed. Working it with the hands when it is nearly cold improves the quality of the wax.

Scions should not be cut in very cold weather, but with this exception they may be taken from the trees at any time between the falling of the leaves in autumn and the swelling of the buds in spring. They should always be taken from healthy and vigorous trees. If cut in the fall, they should be protected as advised for cuttings. Or the following method, described in the *RURAL WORLD*, may be adopted. "Bury them in a dry place out-of-doors, in an inverted open box. Fill the box partly full with them, nail two or three strips across to hold them in place, and then place the box in a hole dug for the purpose, with the open side down, and bury them half a foot or so in depth. They do not come in contact with the earth, and remain perfectly clean; and the moisture of the earth keeps them plump and fresh without any danger of their becoming water-soaked."

Wood of the previous season's growth is usually taken for scions, though some fruit-growers assert that there are certain advantages in using wood that is two years old. Each scion should have at least two buds. Near the base of the lower bud the cutting which forms the bottom into the shape of a wedge should be commenced, and the top of the scion should be cut off a little above the upper bud. The work of grafting is to be performed in the spring after the circulation of the sap has become well established.

THE LARGER FRUITS.

IN all lists of fruit for this country the apple is entitled to stand at the head. It is more extensively grown than any other kind of fruit, and succeeds better than most sorts in adapting itself to its surroundings. There are varieties of apples which can be easily grown in MAINE and MINNESOTA, and other sorts which succeed in GEORGIA and the surrounding States.

The quality of any particular kind will be varied by differences in soil or climate, and it is, therefore, very important that the grower should strive to obtain those sorts which are best adapted to his circumstances and surroundings. The farther South an apple tree is taken the earlier it will ripen its fruit. Some of the finest winter sorts in NEW ENGLAND become autumn apples when grown at the SOUTH, and a few kinds which succeed far North become almost worthless in the MIDDLE STATES.

For the extreme NORTH, the most hardy varieties of the apple should be selected. DR. T. H. HOSKINS, of NEWPORT, VERMONT, has made a specialty of fruit trees for the cold North, and has done a great service to the people of that section by giving them some excellent varieties in place of the old-fashioned crabs which they had supposed were the only sorts suited to their locality. For summer, he recom-

mends the TETOSKY, a large, yellow, sub-acid apple which ripens in August; the RED ASTRACHAN, a large, red, acid apple which ripens the last of August; and the SUMMER HARVEY, which resembles in color and flavor the RHODE ISLAND GREENING, and ripens the last of August. Each of these trees are hardy and productive, the former being "perfectly iron-clad in hardness." Among the autumn apples, the DUCHESS OF OLDENBURGH, PRINGLE SWEET, and ST. LAWRENCE are highly recommended. For winter use, the FAMEUSE, BEN DAVIS, MAGOG RED STREAK, and SCOTT'S WINTER, are hardy, productive, and of excellent quality. For the severest localities, the SIBERIAN crabs, TRANSCENDENT, and LADY ELGIN are excellent; and the MEADER'S WINTER is a fruit of equal quality with the best varieties of large apples.

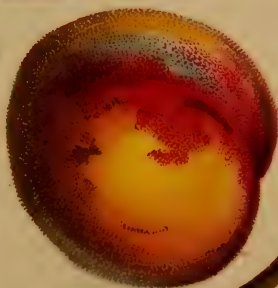
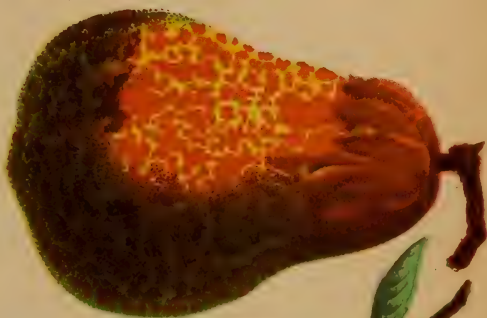
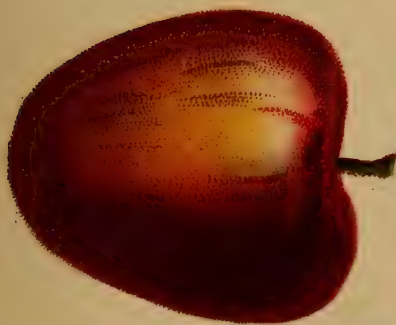
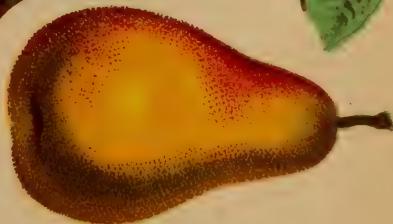
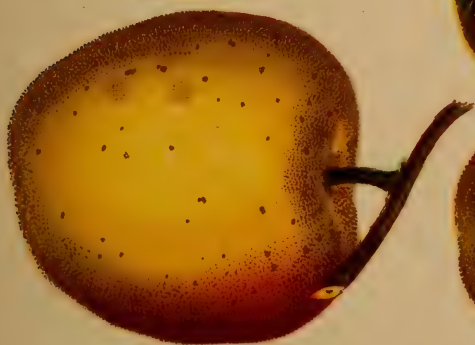
For the localities between the extreme NORTH and the SOUTHERN States a large number of kinds are well adapted. The TETOSKY, EARLY HARVEST, RED ASTRACHAN, PORTER, GRAVENSTEIN, HUBBARDSTON NONESUCH, KING OF TOMPKINS CO., BELL FLOWER, CANADA RED, RHODE ISLAND GREENING, WESTFIELD SEEK-NO-FURTHER, TALLMAN SWEET, BALDWIN, ROXBURY RUSSET, and NORTHERN SPY, have all been thoroughly tested and prove excellent and productive. We consider the PORTER, KING OF TOMPKINS CO., ESOPUS SPITZENBURGH, CANADA RED, WESTFIELD SEEK-NO-FURTHER, BALDWIN, and ROXBURY RUSSET, extremely valuable. The trees are reasonably hardy, and, with the exception of the ROXBURY RUSSET (which is one of the best keeping apples known, and, consequently, entitled to a place in every orchard), very productive, while the fruit is of excellent quality. The PORTER, WESTFIELD SEEK-NO-FURTHER, and CANADA RED are splendid apples for eating, and the first and third are excellent for cooking purposes.

For the SOUTH and SOUTHWEST, the following varieties have been recommended by competent authorities: EARLY HARVEST, RED ASTRACHAN, GRAVENSTEIN, FALL PIPPIN, BELL FLOWER, NEWTOWN PIPPIN, SMITH'S CIDER, AMERICAN GOLDEN RUSSET, SHOCKLEY, RAWLE'S JANET, and STEVENSON'S WINTER.

In the above lists we have only mentioned a few of the very best kinds which are adapted to the localities named. As there are nearly three thousand named varieties of apples, it would be both useless and impossible to give a complete list in this work.

While the farmer should have several varieties of apples, in order to furnish a succession in time of ripening, it is not wise for him to attempt to grow many kinds for the market. For family use the earliest and latest ripening varieties, with several sorts ripening at various times between these two extremes, should be chosen. But even here there should be a limit to the multiplication of varieties, and only the very best ones should be grown. The farmer who has fifty trees representing thirty different varieties of apples has made a great mistake in his selection. Of this fact he will be fully convinced when picking-time arrives, and he tries to keep each sort by itself. But, in growing apples for the market, it is much more important not to have too many varieties. For, if the farmer has a great many different kinds, he will have but a few barrels of any one sort, and the buyers will be likely to want only the ones which are the best known. If the apples were all of some standard variety the whole crop could be readily sold, but where there are many kinds, and but few of a kind, it is much more difficult to make sales.

IN POINT OF QUALITY, PEARS are among our finest fruits; but there is a very general, though unfounded, impression that the trees are tender, and that it is very difficult to obtain a good quality of fruit. The tree is hardy, and is longer-lived than



the climate renders it difficult to grow them now in the upper portions of the State. In central NEW ENGLAND the trees do not thrive as they did twenty years ago, but the fruit can be grown by farmers who are willing to give the trees a moderate degree of care and attention. A writer in the FRUIT RECORDER has said that if peach trees are pruned every year by cutting off from the ends of the limbs, in September, more than one-half the season's growth, and thinning out the branches after the leaves have fallen, this fruit can be successfully grown in the NORTHERN STATES. He also recommends setting the trees (when grown in the NORTH) with Northern and Western exposures, so that the buds will not start in the winter, nor too early in the spring. Treated in this way, he thinks the peach tree may be made to last and be productive for from fifteen to twenty years. We do not think that ordinary trees will live as long as this, but have no doubt that peaches can be grown, if properly managed. If they would set two or three trees each year, so as to have those of different ages constantly in the orchard, and thus provide a succession of young and vigorous trees to take the places of the older ones as they decay or become unfruitful, farmers in almost all parts of the country might have plenty of peaches for home use.

Only a few varieties should be grown. Of the many kinds in cultivation the following are among the best for the farm. For the NORTH, WATERLOO, EARLY BEATRICE, EARLY YORK, RED RARERIPLE, OLD MIXON FREE, CRAWFORD'S LATE. For the MIDDLE STATES, ALEXANDER, GEORGE THE FOURTH, OLD MIXON FREE, SURPASSE, SUSQUEHANNA. For the SOUTH, all the above varieties, and CHINESE CLING, LA GRANGE, GOVERNOR, THURBER, TUSKUNA.

PLUMS are excellent fruit, and if the curculio is kept away they can be easily grown. The tree is hardy and vigorous, and very productive. The trees should be near the house, in order that the curculio may be the more easily destroyed, and, for the same reason, as well as on account of the general objections to having trees in turf, no grass should be allowed to grow beneath their branches. Pruning should be done in spring, when one-half the previous season's growth should be removed. Vigorous sprouts may also be pinched back during the summer. The best varieties for the farmer are the following: GREEN GAGE, IMPERIAL GAGE, LOMBARD, PURPLE FAVORITE, SMITH'S ORLEANS. These sorts succeed over a wide range of country, and, if the enemies and diseases which have been described in a previous chapter are kept at bay, will furnish an abundance of very fine fruit. There are many other good varieties, and in some locations there may be an advantage in putting out some of them in preference to part of those which we have named, but for general cultivation those in the list are first-class.

THE APRICOT belongs to the plum tribe and is an excellent fruit, but cannot be easily grown at the NORTH. It requires a deep, dry and rich soil, and very careful pruning. The trees should stand on the north side of a building or tight fence. The ends of the shoots should be pinched in during the summer, and all feeble buds rubbed off. There are but few varieties at all adapted to farm cultivation. The BREDA is one of the hardiest trees, and the fruit, though very small, is rich and high flavored. The HEMSKIRKE is "one of the largest and best" varieties of this kind of fruit.

THE CHERRY succeeds well in all parts of the country except the extreme NORTH and SOUTH, and there are a few sorts which can be grown in those sections. The trees are hardy and vigorous. They do the best in a rather dry and light soil, and require less fertilizing and pruning than the trees of most other varieties of fruit.

They produce fruit when quite young, and live to be very old. The following are valuable kinds for the farm: BELLE D'ORLEANS, BLACK TARTARIAN, COE'S TRANSPARENT, ENGLISH MORELLO, GOVERNOR WOOD, MAY DUKE.

THE QUINCE grows in the form of a bush rather than a tree, and produces a large, rich fruit which is excellent for use and profitable for the market. The fruit can be kept and transported better than many kinds, and the bushes are very easily grown. A deep loamy soil is best for the quince, but if manure and salt are freely used it will grow almost anywhere. Mulching is very beneficial. The pruning of the quince is a very simple operation, and consists in cutting off the "suckers" which start out near the roots, shortening in the branches which grow the fastest, and thinning out the top enough to freely admit the light and air. There are but few varieties. The ORANGE, though rather tender, is an excellent fruit, and is worthy of a place on every farm. A few bushes of the ANGERS, which is a hardy and productive variety, should also be put out, and a trial, on a small scale, may be made of REA'S MAMMOTH. The farmer who will take a little pains to destroy the borer, and to mulch and fertilize the bushes, can have an abundance of excellent quinces, and from them his wife can make the very finest of preserves and jellies.

THE GRAPE is one of the most delicious of all our fruits, and is very easily grown. There are varieties which succeed in the extreme NORTH, others in the middle section of the country, others at the SOUTH, and a few which can be relied upon almost everywhere. When buying vines select those which are only one or two years old. The land should be in good condition, but need not be extremely rich, and no manure should come in contact with the roots. Spade, or plow, the soil to the depth of a foot, set the vines from six to nine inches deep, where they are to remain, and from ten to twelve feet apart. If room is scarce, the vines can be placed only eight feet apart, trained up to a stake, and closely pruned, but it is better to give a greater distance.

A one-year old vine should be allowed to grow only one cane the first year. Save the most vigorous one, and rub off the other buds. Vines two years old may grow two canes. They should be tied to a stake or run on a trellis. The first year's growth should be cut back, in the fall after the leaves have dropped, to three or four buds. The next spring two canes should be allowed to grow from this stem, and the other buds ought to be rubbed off. With the exception of pinching off the weakest shoots, no summer pruning should be given this season. In the autumn cut the two canes back to three or four buds each, and leave a bud upon the main stalk to grow another cane the next year. The third summer the two strong canes may be allowed to bear a few, *and only a few*, clusters of fruit. Many vines are ruined, and others are weakened, by being allowed to overbear when small. If any fruit sets before the third summer cut it off, and thin the third year's product to a *very* small quantity. Do this thinning, the cutting out of the small stems, and the gathering of the fruit, with sharp scissors. They are much more convenient than a knife, and the work can be done in a better manner.

After reaching the third year the vine can be trained in any desired style. A wire trellis should be provided the second season. This will be more durable than wood, and the vines will attach themselves to the wires, thus saving the grower much time and labor which would be needed for tying up the branches if a wood trellis were used. A plain trellis will do as far as practical matters go, but a pretty one will be not only useful, but also ornamental. For a plain trellis set strong posts in the ground, in a straight line, about eighteen feet apart. If a long line is

to be stretched, the end posts may need bracing. Draw the wires tight, and fasten them with staples to each post. The posts should be six feet in length above the ground. Place the lower wire eighteen inches from the ground, one near the top of the posts, and two more at equal distances between those already located.

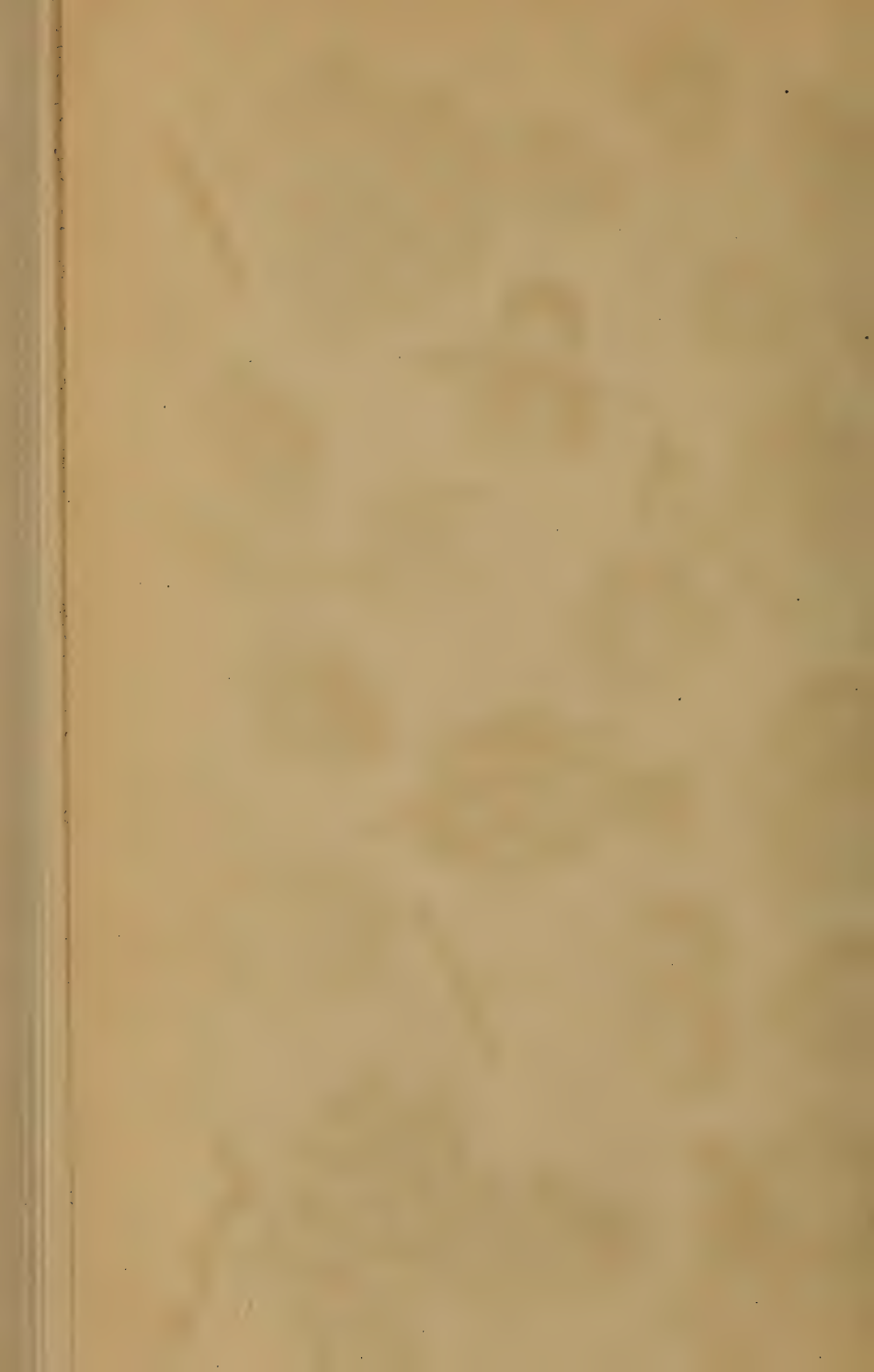
In pruning bearing vines cut away old wood and leave the new, for the fruit buds are on the new growth. A few strong branches should be left every year to provide a succession of canes for the next season. All the small stems of fruit should be picked off as soon as the fruit is well set, and some summer pruning may be given if the vine is too thick to admit the light freely. Care should be taken, however, not to remove leaves from bearing canes, or from canes which are to bear fruit the next year. To this rule the exceptions of pinching off the bearing shoots "three leaves beyond the last stem of grapes," and the shortening in of the future bearing canes when they are as long as it is desirable that they should grow, may be safely made.

In order to obtain the best quality of fruit from the vine, the grapes must remain thereon until they are fully ripe. They are good some time before this period, and, on account of early frosts, or because they are wanted for immediate use, they are often gathered when well-colored, but still only partially ripened. If a vine is trained to the south side of a building, and the fruit remains quite late, it will be much sweeter and better than specimens of the same variety grown in the ordinary manner, and picked at the usual time. If they are to be kept for fall or winter use the grapes should not hang on the vines as long as they should if to be used at once. For keeping they should be gathered as soon as ripe, all imperfect berries cut off with scissors, and the bunches packed in fine, dry saw-dust. The boxes should be kept in a cool place where they will not be exposed to frost, and should not be opened until the fruit is wanted for use.

WINTER PROTECTION should be given in the NORTH. Wherever the mercury falls in the coldest weather to ten degrees below zero, the vines should be taken from the trellis, before severe cold comes on, laid upon the ground, fastened with wooden pegs, and covered with two or three inches of soil. Farther SOUTH, but not where the winters are mild, it is better to merely cover with straw (over which a very little earth is thrown to keep out the mice), as the ground is liable to be too wet. Merely laying the vines upon the ground is much better than to allow them to remain upon the trellis.

OF VARIETIES there are already an immense number, and they are rapidly increasing. One of the very best of the older kinds is the CONCORD. The vine is hardy and fruitful. It succeeds in almost all parts of the country, and is undoubtedly "the most hardy and popular native grape that exists." It is said to be better WEST and SOUTH than it is in NEW ENGLAND. If this is correct every farmer should have a CONCORD grape vine. The CLINTON succeeds best on a light soil. It is a hardy and productive vine, bearing quite acid but very long-keeping fruit. With reasonable care it can be kept through the winter. The DELAWARE is a small but exceedingly rich grape. The vine is not as productive as the CONCORD, and it does not prove as hardy at the NORTH, but the excellence of the fruit entitles it to general cultivation. The DIANA is a good keeper, and by many is considered a fine grape. We do not like its peculiar flavor. The vine is rather tender, and needs protection much more than the kinds previously named. The ELSINGBURG is a small but rich grape. MR. KNOX, a well-known nurseryman, used to recommend this as the best table grape. The HARTFORD PROLIFIC is a good and





and cheaply grown, and, as children, as well as grown people, almost universally are fond of them, the farmer should consider it both a duty and a privilege to devote a small area of land to their production.

OF THE VARIOUS KINDS of the small fruits which should find a place in the farmer's garden, the STRAWBERRY is usually considered of the greatest importance. This fruit is easily grown *if* it is well cared for. If the plants are neglected the fruit is not easily secured. There are several different methods of cultivation. That which is best adapted to the farm is setting the plants in straight rows, two feet and a half apart and twelve or fourteen inches apart in the rows. When it is desired to increase the number of plants of a particular variety they may be set farther apart in the rows, but, when fruit is wanted, it is better to have the plants but a short distance from each other. The land should be very thoroughly prepared, and also made quite rich. Well-rotted barnyard-manure is an excellent fertilizer for this crop. The holes in which the plants are to be placed should be large enough to allow the roots to be spread out. Before setting, the roots should be dipped in soft mud, and all but three leaves should be cut off.

THE TIME FOR SETTING may be either in the spring or early autumn. Some growers prefer the former season, and others the latter. Good plants set in the autumn and well cared for often produce part of a crop of fruit the next summer. Those which are put out in the spring will not bear many berries, and ought not to be allowed to if they show an inclination to produce fruit, but will develop into strong and vigorous plants which will be less likely to winter-kill than those set in the fall. When there is no special haste about obtaining the fruit, we think the spring is the best time for setting plants.

THE CULTIVATION which strawberry plants require consists in frequent hoeings and in keeping the land free from weeds. By using a hand-cultivator between the rows the work can be made much easier than it otherwise would be. The runners may be allowed to grow between the hills, but not between the rows. Some prefer to keep the plants in hills, and do not allow them to spread, while others let them run as they choose and cover the whole surface of the bed. When the latter course is pursued the bed is very likely to become overrun with weeds, and new plants must be put out every year or two. If kept in hills, most of the work of cultivation can be done with a cultivator or hoe, while if the runners are allowed to grow between the rows, there will be more hand-weeding required. But there will also be more plants and a larger quantity of fruit.

At the SOUTH, strawberry plants soon decrease in fruitfulness, and some growers recommend the putting out of a new bed each year in order to have a lot of fresh-bearing plants every season. At the NORTH it pays to start a new bed every three or four years. Plants which are well manured, thoroughly cultivated, and from which the dead leaves and runners are removed after the fruit has been gathered, will remain vigorous much longer than those which are neglected.

WINTER PROTECTION is useful in nearly all parts of the country. In the NORTHERN States it is absolutely necessary if the full productiveness of the vines is to be secured. The embryo fruit buds are formed in the autumn, and severe winters must injure them if they are unprotected. Where deep snows come early and stay several months there is less need of an artificial covering than there is farther SOUTH where the ground freezes and cold rains often fall during the winter. The plants should be covered, an inch or two deep, late in the fall with cut straw, hay, or some similar substance. This to prevent the alternate freezing and thawing of the surface

of the ground, and also to protect the plants from the light. As soon as the weather is warm in spring the material should be loosened from the ground and the tops of the plants uncovered, but it need not be removed, as it will tend to keep down weeds and also keep the fruit clean.

OF VARIETIES there is an immense number, and many new ones are put upon the market every year. There are many kinds which are excellent for the market, and some of still better quality which can be grown for home use, but will not well bear transportation. There are others which are good but not prolific, while other sorts are productive but not very good. Some kinds which are excellent in some localities do not prove valuable in other sections, while some kinds thrive in all sections and upon almost all kinds of soil. The WILSON is a very hardy and productive plant, and is probably more largely grown than any other variety. The fruit is very acid, and is not of first-rate quality. The fact that it can be very easily grown makes it a general favorite. JUCUNDA succeeds in rich heavy soils. The fruit is of good quality, ripens early, and holds out late. CHARLES DOWNING is an excellent and productive sort. PRESIDENT WILDER is of a first-rate quality where it succeeds. DOWNER'S PROLIFIC succeeds well at the SOUTH. MONARCH OF THE WEST is very popular. KENTUCKY is a good variety, and produces fruit after most kinds have finished bearing. Of the newer kinds the GREAT AMERICAN, CRESCENT SEEDLING, SHARPLESS SEEDLING, and MINER'S GREAT PROLIFIC, are destined to prove extremely popular.

There are a multitude of other varieties new and old, many of them valuable, which we have not room to name. In the farm-garden only a few sorts should be grown, and those should be both good and productive.

RASPBERRY.—This fruit is much esteemed by the majority of people, and as the plants grow wild in nearly all parts of the world the inhabitants of all lands can be well supplied. When cultivated the plants are very productive and the fruit is larger than that which grows wild. The red varieties are more tender than the black caps. At the NORTH they sometimes winter-kill, while at the SOUTH the leaves are burned by the summer sun. The black varieties are, therefore, better adapted than the red to general cultivation. They will grow in almost any kind of soil, but do the best in one which is light and dry. The red kinds thrive the best in a rich, deep, and quite moist soil.

The plants should be put out in rows and hills. The red varieties may stand four feet apart each way, but the black kinds should be six feet apart one way and four or five feet the other. The plants can be put out either in the spring or fall. The canes should be cut off even with the ground after the setting is done, and the plants must not bear fruit until the next year. In order to prevent this, and to insure a vigorous growth, severe pruning must be given. In July the canes should be cut off within a foot of the ground and the side shoots shortened in. The second year the top of the new growth is to be pinched off when it gets two feet high, and the side shoots must not be allowed to grow more than two feet in length. This makes strong roots and stocky stems. MR. PURDY, the well-known editor of the FRUIT RECORDER, advises this vigorous cutting of the new growth, and says that it will usually make the stems strong enough to hold up large crops of fruit without being staked. Each year a sufficient number of shoots should be allowed to grow to provide bearing canes for the next season and all others should be removed. The stalk grows one year, bears fruit the next, and then dies. After the fruit has been picked, the canes which produced it should be cut off at the surface of the ground.

During the whole season the ground should be kept free from weeds. The use of a horse-cultivator between the rows, and a liberal mulch of old hay close to the hills, will prove a great help in this respect, and also promote the growth and productiveness of the plants. If well cared for, the roots will last for many years.

WINTER PROTECTION is needed by most of the best varieties. This is best given by a light covering of earth. The canes should be bent down upon the ground, a shovelful of earth thrown upon the tops to keep them in place, and then a furrow plowed each side the row will furnish sufficient covering. In the spring the canes can be loosened with a fork.

OF VARIETIES the CLARKE, NAOMI, and PHILADELPHIA are among the best of the fully established kinds of the red berries; BRINKLE'S ORANGE is a fine yellow variety; and the MAMMOTH CLUSTER, DOOLITTLE, and DAVISON'S THORNLSS, are among the standard black caps. Of the above the three former are propagated by suckers, and must have winter protection at the NORTH. BRINKLE'S ORANGE is also tender, and is propagated in the same manner. The three latter are hardy, and are increased from the tips of the new wood.

BLACKBERRY is a common fruit, growing wild in nearly all countries and also extensively grown for home use and for market. The plants are very strong growers and require more room than the raspberry. Otherwise the cultivation is nearly the same as already described for that fruit. The surface of the ground must be stirred often, but not too deeply. If the roots are broken, a large number of new plants will grow, and the whole bed will soon be filled with them. Mulching is very useful. Severe pruning must also be given. If the canes are allowed to grow more than three feet high, with side branches two feet long, a stake must be set in each hill and the canes tied to it. But if severely pruned, staking will not be necessary. Three or four stalks are enough for a hill.

THE FOLLOWING VARIETIES are among the best for farm purposes: WILSON'S EARLY and KITTATING are reasonably hardy, though needing winter protection in some localities, and produce large quantities of excellent fruit; MISSOURI MAMMOTH, and SABLE QUEEN are newer sorts of great promise, and the WACHUSETT THORNLSS, which is now being introduced, seems destined to be very popular.

CURRENTS are among the most common of the small fruits. They are easily grown and very productive. Although often neglected and allowed to stand in the sod, these bushes ought to be cultivated and hoed. If properly cared for they will produce much larger and finer fruit than can be obtained from neglected bushes. At the SOUTH, mulching is necessary, and, at the NORTH, it is highly beneficial.

Pruning should not be neglected. The old wood should be cut out each spring and the fastest-growing branches should be pinched in during the summer. The fruit grows on wood which is two, or more, years old, but very old stems are not as fruitful as newer ones. Only three or four stalks should grow from a single root, and new plants should be put out every few years. The plants should be four feet apart, and fertilizers should be freely applied to the soil. Keep off the currant-worm, as directed in a previous chapter, and plenty of fruit can be obtained at a very small cost.

OF VARIETIES the RED DUTCH, CHERRY, and LA VERSAILLES are the standard red sorts. The WHITE GRAPE is the best white, and the BLACK NAPLES the best black variety. Of the white and black currents, MR. A. S. FULLER, in his valuable work on small fruit culture, says the former is less acid and is richer than the red,

while the black is less acid than either but has a musky flavor. The black currant is a stronger grower than the other sorts and produces considerable fruit on the new wood. Consequently, it needs more room and less pruning than the other kinds. The fruit of the black variety is considered valuable for jellies. New plants, of any variety, can be obtained from cuttings or by layers.

GOOSEBERRIES are excellent for jellies, are used for making pies, and for various other household purposes. The plants are much like the currant but require more care. They should be set in a rich soil and be heavily mulched. A Southern exposure should be avoided. Pruning should be done in the fall after the leaves have dropped. There should be plenty of room for the light and air among the tops. Mildew often destroys both the fruit and the plants. As a remedy for this disease, MR. FULLER recommends the use of flour of sulphur dusted over the bushes while the berries are growing. He also recommends the putting out of new plants each year so as to have a constant supply of those which are young and vigorous. Foreign varieties are much more subject to this disease than the native sorts. HOUGHTON'S SEEDLING, the DOWNING, AMERICAN SEEDLING, and SMITH'S IMPROVED are among the best kinds for the farm.

CRANBERRIES are a very healthful and delicious kind of fruit. They are extremely useful in the treatment of many diseases, and are a valuable article of diet for people who are well. The plants are semi-aquatic, though there are varieties which do passably well on uplands. In order to secure the best returns from them, cranberries should be grown where water can be freely used. The water is needed to promote the growth of the plants, to protect them from the severe cold of winter and the late spring frosts, and to destroy the worms which sometimes infest them. In many places cranberries grow wild. One of our friends has a large lot of plants in his mowing, and, though he does nothing in the way of cultivation, he obtains several bushels of good fruit every other year. In favorable locations the cranberry can be grown in this manner very easily. Small pieces of vines may be set in the turf, or berries, or pieces of vines, may be sown upon the land. If the land is fitted for them, and good plants are set out, the result will be much better than can be secured from any such superficial methods, and, where the fruit is to be grown for the market, this ought always to be done. The cranberry, like all other fruits, is improved by cultivation. But, if the farmer is to grow only a small quantity for family use, he cannot afford, and does not need, to incur much expense in fitting the land.

If the plants are to be set on low land the surface-water should be got off by drains. Large plants should be secured from some productive bed (some vines being nearly barren) and set in rows two feet apart each way. If small plants, or pieces of vines, are used, they should be set nearer together. If the weeds and grass are kept down for two or three years the vines will occupy all the land. This can be facilitated by spreading sand upon the surface, to the depth of two inches, before the plants are put out.

Farmers who have no low land which is convenient, or is suitable for this purpose, can put a few plants of the upland variety in their gardens with a reasonable certainty of obtaining fruit. If a liberal application of muck can be made to the soil it will be an advantage, and the plants should be thoroughly mulched. For this purpose the MANSFIELD CREEPER is one of the best kinds. This is a new variety described by MR. J. J. H. GREGORY, the well-known MASSACHUSETTS seedsman, as of different growth and habit from other kinds. The cuttings root freely, thrive on moderately dry soils, and are quite productive. For low land the

EATON BLACK BELL is a very early variety, and some of the common "Bell" and "Cherry" kinds are still quite popular. Plants should be put out in the spring, though they will be likely to grow if set in early summer or in the fall.

THE FARM-GARDEN.

IN order to secure the best returns from the farm-garden, some changes from the common form of management will be required. A larger area of land must be devoted to the garden, a larger variety of vegetables and fruits must be grown, and the growing crops must be more thoroughly cultivated.

COLD FRAMES.—Several varieties of the plants which should be grown in the farm-garden are much more fruitful when transplanted than they are if allowed to grow where the seed is sown. There are others which the grower in the NORTHERN and MIDDLE States desires to obtain earlier than he can get them by planting in the open land. For these reasons many farmers start their tomato-seeds, and several other kinds, in boxes or pans of dirt which they keep in the house. This method is quite inconvenient, and the results are not altogether satisfactory. It is much better to make what is known as a "cold frame," and in this start the plants which are wanted earlier in the season than they can be obtained by sowing seed in the open ground. This is a plank box covered with glass. A sheltered location with a southern exposure should be selected. The land should be dry and level. Set four posts in the ground at the corners of the frame and fasten the planks to them. The back side of the frame should be about a foot high and the front about eight inches. For ordinary farm use, a frame seven feet long and three or four feet wide will be large enough. The end pieces should be made narrow in front and wider at the back side in order that when the top is on there shall be no cracks through which the wind can enter or the warm air escape. The top should be principally made of glass. Old windows answer every purpose.

The soil within the frame should be deeply spaded, finely pulverized, and a liberal quantity of stable-manure should be worked in. The surface soil must be made very fine, and the front slightly raised. The soil should be worked just before the seeds are sown, as the natural moisture of the land will facilitate their germination. But if the seeds are to be put in during very cold weather, or while the ground is still quite cold and damp, the sashes should be kept on for a few days previous to the sowing in order that the soil may become partially warmed. The bed should be watered every morning. During warm days the sashes should be raised a little, by means of wedges or sticks placed under them. Late in the season it may be necessary to cover every other pane of glass with whitewash, or else cover the whole with a blanket during the middle of the day, in addition to the raising of the sashes. A little experience will enable any one to determine when the heat is too intense. If the plants grow very fast and "spindling," the bed is too warm, and more air should be admitted. As the days grow longer and the season becomes warmer, the sashes may be taken half-way off during the day. When a "cold snap" comes, the sashes should be covered during the night with an old blanket. In all cases the plants should be somewhat exposed to the air, by opening the sashes a few hours each day, before they are removed to the open ground.

TRANSPLANTING is an operation which often needs to be performed. While it is important that this work should be done in the best possible manner, it is frequently rendered wholly useless, and the plants which are taken are spoiled, because those who put them out do not understand the best methods, or are careless in following them. If properly performed, at a suitable time, but very few plants will be lost. Even in an unfavorable time most of the plants can be made to grow if they are skilfully managed. But as far as possible a good time should be chosen. The ground should be fitted only a short time before the transplanting is done, and if a rainy day can be used, the plants will start sooner, and grow faster than they will if the sun shines brightly, and the ground is dry. Most plants should be set rather deeply—down as far as the first leaves—and the earth should be packed firmly around the roots. The best way to set plants which have a single straight root is to make a hole with a smooth stick, considerably larger than the root, but not much deeper than will be needed, put the root into the hole thus formed, and then make



FIG. 127.—TRANSPLANTER.

another hole close to the root, and as deep as the one in which it was placed. This will pack the soil closely around the root throughout its entire length, and will do a great deal towards making the operation a success. Plants with many roots, like the strawberry and tomato, need different management. A hole of sufficient size to allow the roots and fibres of the plant to be spread in their natural position should be made, and the earth packed closely upon and around them. It is also well to dip the roots into thin mud before setting the plants.

For use when the plants are to be reset near where they grew, the implement shown in Figure 127 will be very useful. Quite a quantity of earth can be taken, the roots will not be seriously injured, and the growth of the plant will hardly be checked.

For transplanting in dry weather, the GERMANTOWN TELEGRAPH recommends the following plan: "Make a lot of holes with a dibble, deep down in the earth where the plants are to grow, and fill these holes with water. It will soon soak away, leaving the ground in a half-dry, half-wet condition. The plants to be set out are taken from the seed-bed and put into a bucket or basin of water. That is, the roots are, but the tops are kept out in the dry. They are one by one taken out, put in the holes, pressed firm, and the job is done. They need no more water than this, do not wilt much, and grow right away much better than when treated to a shower-bath in the regular old-fashioned sort of way. But suppose the weather continues dry, are they never watered? They are; but even here progress has found a better plan than that of the olden time. The earth is removed with a hoe, just a little about the plant so as to form a sort of basin about the stem; the water is poured into the basin, and in an hour or so after the water has all soaked away, the earth is drawn in, and the whole surface is as before. This is a once-for-all operation, and let the

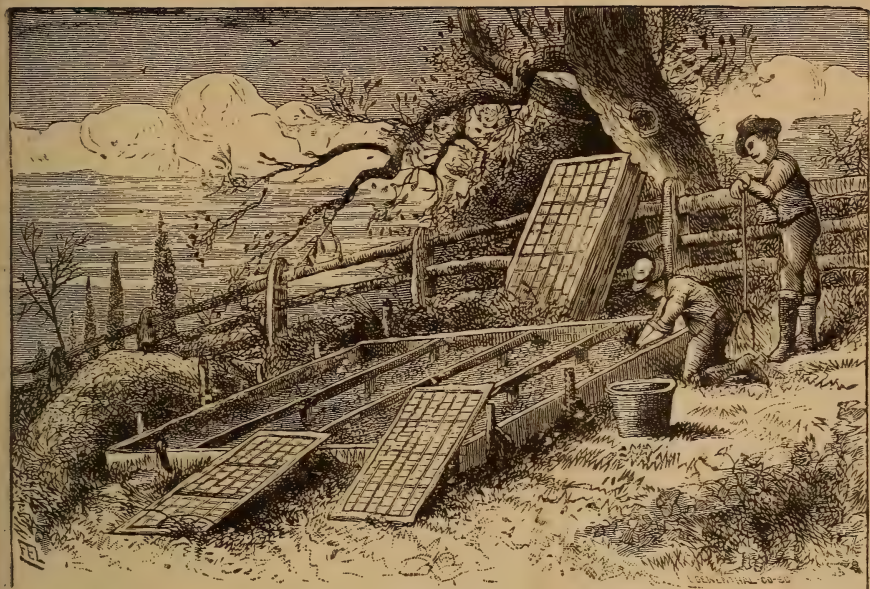


FIG. 128.—COLD FRAME.

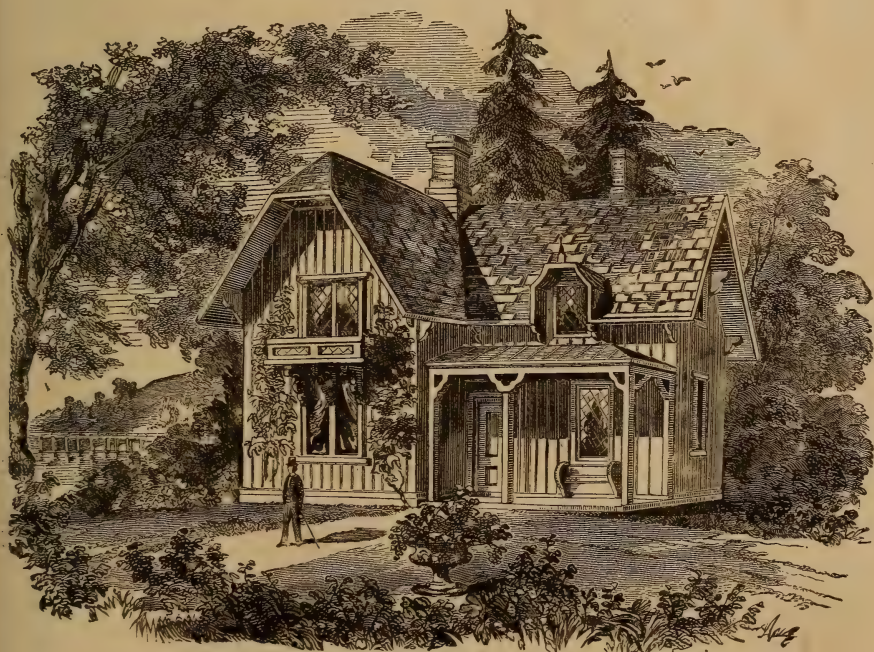


FIG. 129.—HOME ADORNMENT—SHRUBS, EVERGREENS, AND FLOWERS.

weather be ever so dry it is seldom that a plant requires more than one or two water doses of this character during the dry spell."

VARIOUS GARDEN CROPS.—Many crops are grown in both the garden and the field. To several of these we have already alluded in treating of farm crops, and the directions there given for cultivation can be very easily modified to suit the garden. Nearly all the garden plants need a rich soil and thorough culture. Several of the common plants are found in every garden, and their cultivation is already understood. Therefore we shall occupy but little space in treating of them.

ASPARAGUS is not as generally found in farm-gardens as most other standard plants for garden cultivation. If the land is made rich and thorough culture is given there will be no trouble in obtaining a good crop. The land should be deeply plowed in the fall, a heavy application of well-rotted stable-manure should be made, and another plowing given. The soil should be finely pulverized, and furrows eight inches deep should be plowed for the rows. These furrows should be five feet apart, and the roots placed in them, covering the crowns about an inch. When the stalks appear, hoe the dirt around them, thus gradually filling the furrow and levelling off the surface of the ground. In the fall spread on manure, and plow a shallow furrow toward each side of the rows. In the spring harrow the surface level, and keep the ground loosened, and the weeds down during the whole season. The next fall plow a furrow each side *away* from the rows, throw in manure, and then plow the earth back over the rows. The next spring harrow the earth away. A few of the strongest shoots can be cut, but no general cutting should be allowed until the next year. Cultivate thoroughly every year, and continue to give the same treatment in the spring and fall as has been recommended. After the third year coarse salt may be freely applied. The stalks should be removed before the seeds are ripe. If land enough for this method cannot be spared, the rows can be placed two feet apart, but this will make it necessary to do the work of cultivation by hand. The soil must be kept loose with a fork, and liberal quantities of manure must be worked in. The cutting for table use should be done before the heads burst, when the plants are about six inches above the surface, and they may be cut four inches below the ground.

BEANS.—Both the bush and the running beans should be grown in the garden. Planting must be deferred until the weather and the ground are warm. They should be kept free from weeds, but it is not well to hoe them when wet with either dew or rain. The running beans should be provided with sticks upon which to climb. There are many varieties. The **LIMA** is quite different from, and much superior to, the ordinary kinds. The seeds are very large and white, and the vine is a vigorous grower and prolific bearer. The seeds must be planted with the eyes downward, and long poles must be provided for the vines. Planting must not be done until the ground is warm. As the frost proves destructive this variety does not ripen at the extreme **NORTH**.

BEETS are easily grown, and the early kinds are useful for the leaves as well as the roots. Sow in long rows, with a seed-sower, eighteen inches apart. Cover the seeds an inch deep. If sown by hand soak the seeds in warm water for a day or two. For early use sow as soon as the ground can be worked in spring; for autumn sow in May, and for winter use in June. Thin the plants to from six to ten inches apart. The leaves of the young plants are good for "greens." During the season weeds should be kept down, and the ground ought to be often stirred.

THE CABBAGE needs a deep, rich soil and thorough culture. The seed should be

sown in beds, and when they are of a suitable size the plants should be set out in hills. At the SOUTH the plants may be set in the fall, but at the NORTH the seed should be sown in a cold frame in March for the early varieties, and in open land a month later for the late kinds. The plants must not crowd each other in the seed-bed. The hills should be two feet and a-half apart each way, and only one plant should stand in a hill. The ground should be hoed often, and when the plants are half-grown it should be worked deeply and hilled up around the stalks. The disease known as "clump-root," or "club-foot," often proves quite destructive. When affected with this disease, the plants "head under ground" instead of above it and are rendered worthless. To prevent it, plant cabbages on a different piece of land each year, and use well-rotted stable-manure, bone-dust, or guano, for fertilizers. Planting year after year on the same land, or the use of hog-manure, will be likely to induce an attack and cause the destruction of the crop.

THE CARROT is a palatable and useful article of food, and should be more generally found upon the tables of the farmers. We have already recommended its cultivation for stock and given directions therefor. The garden culture should be nearly the same as that recommended for the field. For early use, sow seeds of an early variety as soon as the ground is warm in spring. For winter use, sow about the first of June. If sown by hand, the seed should be soaked twenty-four hours and then rolled in plaster. Prepare the ground just before sowing the seed. The land should be rich from previous manuring, but no fresh stable-manure should be applied. If any fertilizer is needed, use bone-dust, guano, or ashes. It is not well to cultivate deeply, but all weeds should be kept down, and the plants thinned to eight inches apart.

CELERY is not as easily grown as most garden plants, but it furnishes a "delicate and most delicious salad," and physicians strongly recommend its use. The seed should be started in a cold frame, or in some sheltered place in the open land. As soon as the plants are six or eight inches high, they may be set in rows five feet apart and six inches apart in the row. Some set them upon the surface, but it is better to dig trenches a foot and a-half deep and a foot wide, throw in well-rotted manure until the bottom is covered six inches deep, cover this with two or three inches of soil which should be mixed with the manure and trodden down a little, and then throw on an inch or two of fine soil in which to set the plants. Set the plants carefully after removing all the suckers. During the summer keep the soil loose around the plants, water with liquid manure, and as they grow pull the earth up around them as directed for asparagus. The earthing should be done when the plants are dry, and care must be used not to get any dirt into the centre of the top. About a month before they are wanted for use, and while the weather is quite warm, they should be wholly covered with a few inches of earth, and the top of the ridge thus made should be slanted off so as to protect from rain. Good cultivation and the occasional application of a small quantity of salt will improve the quality. For winter protection B. K. BLISS & SONS, the NEW YORK seedsmen, recommend the following: Take up the plants "before severe weather sets in, and lay them in as closely as can be done without crowding the leaves, on a ridge of soil, with their tops sloping downwards, and three or four layers deep on each side of the ridge. Cover with four inches of soil, over which place straw or leaves about one foot thick; on this a roof of boards to throw off the water. When wanted for use open at one end."

CORN of the sweet varieties should be grown for boiling and roasting. Make the

land rich and cultivate often. The planting should be done at intervals of two weeks in order to furnish a succession during the season. For early use, plant the earliest varieties as soon as safe from frost, and for later use, the kinds which ripen late in the season.

CUCUMBERS are not remarkably healthful, but they find a place in almost all gardens. The seed should not be planted until the ground has become dry and warm. Make large hills, four feet apart, put into each a shovelful of rotten manure, or a liberal quantity of ashes, which should be mixed with the soil and slightly covered. Plant ten or a dozen seeds in each hill and cover half an inch deep. When the striped bug comes, as he will be likely to before the plants are very large, a constant watch must be kept or they will be destroyed. It is best to begin defensive operations *before* he makes an attack. We dust our plants with plaster. This must be applied when the leaves are wet and repeated every day or two until the enemy has disappeared. Some growers recommend watering with a weak solution of tobacco and soft-soap, and then putting on bone-flour. A still better way, because it can be done once for all, is to tack some pieces of board together in the shape of a box, cover with mosquito netting, and set over the hill. When the plants begin to run they should be thinned to three or four in the hill. They should be hoed often, and all weeds should be kept out of the hills. For pickles, plant the later varieties during the first half of the month of June.

The DANDELION is entitled to a place in the farm-garden. The tops make excellent "greens," and the roots furnish a good substitute for coffee. Sow the seed in drills a foot apart, and thin the plants to three inches in the rows. Cultivate well, and, the next spring, both tops and roots will be large enough to use.

HERBS.—A few herbs should be found in every country garden. Of those which are both common and useful, the following will be found the best.

HOARHOUND is valuable for medicinal purposes, and bee-keepers can profitably grow it as a honey-producing plant. Sow the seed in a warm, light soil, in rows a foot and a half apart. Thin the plants to nine inches apart in the row. Keep free from weeds. Cut just before the plants come into full blossom. Like all other herbs, these plants should be cut in dry weather and stored in a dry, cool room.

SAGE is entitled to the first rank among the garden herbs. It is used for "seasoning" various articles of food, and also as a medicine in some diseases. The seed should be sown in rows fifteen inches apart and covered nearly an inch deep. The soil should be made very fine, and the seed sown when the ground is quite warm. When the plants are a few inches high they should be set in hills a foot and a half apart. During the season they ought to be hoed several times. They are quite hardy, and, if grown on dry ground, will usually live through the winter. Each spring the plants should be taken up, the roots, several of which will be found in each hill, parted and reset. We often give away half or two-thirds of our sage roots when we transplant and still keep the stock good. The stems should be cut just before blossoming and spread in the shade to dry. If seed is wanted, some of the finest stalks should be left for the purpose. The seed will be black when ripe, and, as soon as it is well colored, the stems upon which it is produced should be cut and dried.

SWEET MARJORAM.—The seed should be sown, in a rich and finely pulverized soil, when the ground is warm, in rows fifteen inches apart. Cover but slightly, and press the dirt firmly over the rows. When large enough, set out the plants in rows a foot apart, and give the same distance between them in the row. Cut when

in blossom. Seed must be sown every year as the plants will winter-kill. **Save** the finest stems for seed, and, when the leaves and tops begin to dry, cut and store in a dry place.

SUMMER SAVORY.—The seed should be sown early in the season, and only slightly covered. Rows should be fifteen inches apart, and the plants should not be taken up. If too thick, remove the surplus ones. Cut when in blossom.

THYME.—The seed should be got in early, in a finely-prepared soil, and only slightly covered. Transplant into hills a foot apart each way. The plants will live through the winter. The roots should be taken up in the spring, parted, and reset as directed for sage. The cutting should be done when the plants are in blossom.

HORSE-RADISH should be grown in a rich soil which has been deeply plowed. It is propagated from pieces of the root. Plant in the spring, eighteen inches apart, in holes deep enough to allow the top of the root to be covered three or four inches. Pack the soil closely around the roots. Hoe often enough to keep down the weeds. The roots will be large enough for use in the fall.

LETTUCE.—Sow in a light, warm, and rich soil. Cover slightly. If the head varieties are grown, transplant in hills a foot apart each way. Or, the plants can be set between the cucumber and melon hills. Most of them will get out of the way before the vines need the land. The richer the soil and better the culture which this plant receives the better will be the quality of its leaves.

MELONS should have a warm, light soil and plenty of manure. Some of the finest melons we ever saw were grown in a sandy and almost exhausted soil. Use rotten manure or a good compost. Work the fertilizer into the soil in and around the hills. Plant when the ground is warm. Use ten or twelve seeds in each hill, and, when the plants begin to run, thin to three or four. Make the hills for muskmelons six feet apart each way, for citrons and watermelons nine or ten feet apart. Keep free from weeds. Citrons and watermelons mix very badly, and, if seed is to be grown, the plants must be a long distance apart. If grown in the same garden the fruit will be good but the seeds will be worthless.

ONION culture has already been described in the pages devoted to farm crops. For garden culture much the same course should be pursued as is there recommended.

PARSNIP.—When grown for the table, the parsnip should have a rich and deep soil which was heavily manured the previous season. Sow the seed, very thick, early in the season, in drills fifteen inches apart and half an inch deep. Cultivate well. In the fall take up enough roots for winter use and store in the cellar. Leave the remainder in the ground until spring, but before freezing weather cover the tops with a little earth.

PEAS are among the essentials in every garden. For early use sow as soon as the ground can be worked in the spring. The soil should be moderately rich. Weeds should be kept down, a small quantity of dirt should be drawn around the stems of the plants when they are a few inches high, and bushes should be set for them to climb. If the land is dry, cover quite deeply. Otherwise, cover two or three inches. We sometimes sow peas in the bottoms of the furrows when we plow. In dry weather they do better in this way than when more lightly covered. For a succession sow at intervals of two or three weeks. Also sow the later varieties.

POTATOES.—A few early, and some sweet, potatoes should be grown in every farm-garden in those sections where they succeed. Plant in rows and care for as

already directed for field culture. These and the different kinds of vines should be grown upon one side of the garden so that they can be cultivated by horse power.

RADISH is highly esteemed by many people and is easily grown. Sow the seed in drills a foot apart and cover lightly. Thin to three inches apart in the rows. Sow in the spring for early use and in August for winter. The soil should be rich, but no fresh manure should be used if the best quality of roots is desired.

RHUBARB can be grown from the seed or from pieces of the roots. The latter process saves two years' time. If seed is used, sow in the spring, in drills a foot apart, and thin the plants to three inches. Transplant the next spring, into rows three feet apart each way, into a rich soil, and give good cultivation. If roots are used, set them in hills, in rich land. Cut all the seed stalks as soon as they appear. If more plants are wanted, divide the roots in the spring.

The **SQUASH** is easily grown in some sections, while in others its insect enemies make its production a matter of great difficulty. The land should be very rich and the hills should be eight or ten feet apart. Manure and room are great essentials. Plant when the ground is warm, using plenty of seed, and thin to two or three plants in a hill when the vines commence running. Use plaster on the leaves as recommended for cucumbers. This will tend to keep away the bugs. Where the maggot proves destructive, the vines must be closely watched. The eggs from which these enemies are hatched are laid on the stem near the root and at the point of union of the leaf stalks and vine. The maggot bores into the vine, and if seen soon enough may be destroyed with a sharp wire, but if given his liberty for a few days he will destroy a large vine.

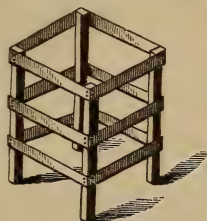


FIG. 130.
TOMATO FRAME.

TOMATO.—Sow the seeds in a cold frame, or in a box of earth in the house, if very early plants are desired. If not, sow in open land as soon as the ground is warm. Cover lightly. When the plants are three inches high they should be taken up and put in a sheltered place. Transplant again when they have become well rooted. This will give stronger plants than can be secured if they are set out only once. For early fruit set the plants in a dry and gravelly soil. If a large and rather late crop is wanted, set in a rich and moist soil. Hoe often, give plenty of room, and tie each plant to a stake, or set a frame around it like that shown in Figure 130. After the fruit sets pinch off the ends of the vines. Tomatoes are said to contain considerable oxalic acid and are considered very healthful.

TURNIPS, in small quantities, may be grown in the garden. The cultivation both of flat turnips and ruta bagas will be much the same as directed for the field. To obtain a succession sow some of the early varieties as soon as the ground is warm, and the later sorts when the season is further advanced. For winter use the seed of flat turnips needs sowing about the first of August, and the ruta bagas about the middle of June. The former should be sown in drills and cultivated, the latter should be transplanted, and hoed quite often.

The great essentials to success in farm gardening are heavy manuring, plenty of room, and thorough cultivation. These any and every farmer can give, and by giving them he can make his garden the most profitable part of his farm.

On the following page we present illustrations of choice varieties of Garden Vegetables. For several of these cuts we are indebted to the well-known seedsman, H. A. Dreer, of Philadelphia, Pa.



FIG. 131.



FIG. 135.

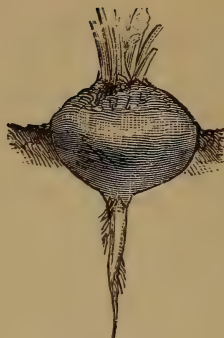


FIG. 137.



FIG. 140.



FIG. 132.



FIG. 136.



FIG. 138.



FIG. 139.



FIG. 141.



FIG. 133.



FIG. 134.



FIG. 142.

FIG. 131.—BASTIAN'S HALF-LONG BLOOD BEET.
 FIG. 132.—EARLY HALF-LONG SCARLET CARROT.
 FIG. 133.—EARLY JERSEY WAKEFIELD CABBAGE.
 FIG. 134.—GREEN CITRON NETTED MUSK-MELON.
 FIG. 135.—EGYPTIAN BLOOD TURNIP BEET.
 FIG. 136.—IMPROVED LARGE PURPLE EGG-PLANT.

FIG. 137.—BASTIAN'S EXTRA EARLY RED BEET.
 FIG. 138.—SMALL GHERKIN, OR BURR-CUCUMBER.
 FIG. 139.—EARLY WHITE SCALLOP BUSH-SQUASH.
 FIG. 140.—DWARF CELERY.
 FIG. 141.—MARTYNIA.
 FIG. 142.—DREE'S SELECTED TROPHY TOMATO.



BUSINESS PRINCIPLES.

(817)

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BOOK-KEEPING.

FALSE ECONOMY.

A GOOD REPUTATION.

INSURANCE.

USEFUL TABLES.

BOOK-KEEPING.

WHEN properly managed, farming is safer than almost any other kind of business, and pays a larger percentage of profit in proportion to the time spent in learning its requirements and the amount of money invested in its prosecution. Although in many kinds of business an apprenticeship of several years must be served, farming is open to the new beginner and he is perfectly free to introduce himself and go to work. The doctor and lawyer spend several years in study before they attempt to enter their chosen fields of labor, and the merchant and mechanic spend considerable time in learning the methods of managing the business which they design to follow. A few farmers take the same initiatory steps, but there are not many who incur any expense in order to master the details of the business before they start for themselves. Yet, in spite of this great disadvantage, there is a much larger proportion of farmers who succeed in business than there is of men engaged in other occupations. This does not follow because study and training are of no benefit in preparing a man to farm successfully, but because the business of farming is much safer and will bear more bad management than almost any other kind of work in which he can engage.

But in order to secure the highest degree of success the farmer must manage his business by business principles. Although he may get a living for himself and his family if he allows things to take their course, he cannot make as large a profit as he could easily secure if he managed his business instead of allowing his business to manage him.

One of the first things which the farmer needs to acquire in order to fit him for this department of his work is a knowledge of book-keeping. It is not necessary that he should master the whole science, but he ought to know the fundamental principles and be able to apply them. These principles are few and simple. It is strange that in our public schools this branch of education has been so sadly neglected. Many a young man has been to school many terms, and obtained a great deal of knowledge of various forms and information concerning a multitude of subjects, and yet been left profoundly ignorant of the methods of keeping books in business transactions. He has not been obliged to do business many years before he has found that a thorough knowledge of the leading principles of this science would have been worth a great deal more to him than the acquaintance with the dead languages which he studied so hard to obtain. Many a man would have been saved from financial ruin if he had been educated in book-keeping instead of the **LATIN** and **GREEK** languages. These languages are excellent subjects for study if a boy has time to master them, but when he comes to the hard work of life he will find that the ability to read them will not enable him to manage a farm successfully or aid him to any great extent in getting a living at any kind of manual labor. In every public school which children fourteen years of age attend the elementary principles of book-keeping should be taught. No young man is fitted for the business of life and no young woman is competent to manage the affairs of a household until some knowledge of this science has been secured.

There are various reasons why a farmer should keep a regular account of his business transactions. A "good and sufficient" one may be found in the fact that it is the only way in which he can have, at all times, an exact knowledge of the condition of his business. If he keeps no accounts he cannot tell whether

he is making or losing money, and will never be able to know how much he is worth.

Another reason why he should keep a careful record of his business is to be found in the fact that if he neglects to do this he will sustain many losses which he might have prevented. He will forget dates and prices, and for many things which he sells he will receive no return. In every community there are men who take advantage of the easy-going farmer who neglects to charge what he sells, who buy of him "little and often," and who never design to pay for what they obtain. Such losses in the aggregate make quite a drain upon the farmer's resources.

Still another reason for keeping accounts is to be found in the habits of promptness which such a course tends to form and confirm. It is not the man who keeps his books carefully who is always behind time in every business enterprise. He is likely to attend to things promptly. The man who thinks it of no consequence whether he ever makes a written statement of his business or not, is almost sure to fall into other easy habits which will strongly tend to his own disadvantage.

But one of the strongest reasons for the course advised is the fact that it tends to keep a man out of debt. The farmer who keeps no accounts is generally ready to pay eight or ten per cent. interest for money when he wants to borrow, but the one whose books are properly kept knows that he cannot afford to pay as much, and will try to secure what capital he needs at a lower rate. The man who keeps strict accounts knows what money is worth, and how much labor a dollar represents, far better than his neighbor who has no account books. The one will be very cautious about getting into debt, and very anxious to get out if a debt is incurred, while the other will be ready to borrow money, but slow to repay what he has borrowed. There are exceptions to this rule, as there are to nearly all others, but the tendency of the habit of keeping accounts with care and precision is to keep a man from debt and from careless speculation, and to greatly advance his pecuniary interests.

The cost of the necessary books is very small, and but little time will be needed in which to make the records. Business transactions should be noted *immediately*. It will not do to trust to memory, as that often proves very treacherous. Every evening the books should be brought up to date. A record should be made of the work which has been performed, as well as of the financial transactions of the day. The latter items, however, should not be left until evening if they are of more than ordinary importance, but should be noted as soon as there is an opportunity to record them.

The books which will be needed are a Diary, Day-Book, and Ledger. If an account is kept with each crop, and with separate fields, another book will be a convenience, though not an absolute necessity. For a Diary many farmers use a cheap pocket form, but one about eight by six inches, with three days for each page, would be better. In this book a record of the work and weather should be made. It should be a history of the work of the farm, and the life of the farmer. If the farmer or any of his family go away from home, or receive visits from friends, or any special business is transacted, the facts should be briefly but clearly noted. Such a record often proves of great financial value, and it is always convenient and useful for reference. For a Day-Book a blank-book about ten and a half by seven and a half inches, with two hundred and fifty pages, ruled on the left for the number of the page of the Ledger to which the account is transferred, and with two double columns on the right for dollars and cents, will do very well. All purchases and sales with the dates and prices, whether paid for, or bought, or sold on credit,

should be noted in this book. The debtor account can be kept on one page and the creditor account on the opposite one if desired.

The main difficulty which most people have in book-keeping is to determine just what to charge, and for what to give credit. But the necessary forms for keeping farm-accounts will be clear to any one who will give the subject a little careful thought. MR. WARING has given the following rule: "When you let your neighbor, or he with whom you deal, have anything from you, it is a *charge* against him, and you must charge him with it on the debit side of the account; but whenever you receive anything from him, it is a *credit*, and you must credit him with it on the credit side of the account." If you sell your neighbor a load of hay which he does not pay for when it is delivered, he becomes your *Dr.* (debtor) for the value of the hay. If you buy a cow, without paying cash, of another neighbor, that neighbor becomes your *Cr.* (creditor) for the price of the cow. Accounts can be kept with crops, or fields, or animals, in the same manner. A crop is *Dr.* to the use of the land and expense of preparing it, the value of the seed and cost of planting or sowing, to the expenses of cultivation, harvesting, preparing for market, and delivering at the place agreed upon; and *Cr.* by the amount of money received for what is sold, and the value of the portion used at home. A cow is *Dr.* to her first cost, interest on money invested and the expenses of keeping; and *Cr.* by the value of her calves and milk. The same principle applies to all business transactions.

The work can be done in less time and with less labor if a book prepared expressly for farm book-keeping is obtained. The publishers of the OHIO FARMER have strongly recommended their readers to keep accurate business accounts, and, in order to aid them in this work, have prepared a two hundred page "FARMER'S ACCOUNT-BOOK," which contains a system of keeping accounts which is specially adapted to the wants of farmers and stock-owners. This book has printed headings for the various departments of the farm business, including Plan of Farm, Purchasing Accounts, Sales Accounts, Individual Accounts, Consignments and Accounts Sales, Laborers' Accounts, Cash Received and Cash Paid Out Accounts, together with many useful rules and calculations. The book is large enough to last an average farmer three years and costs only one dollar. With the paper, published at CLEVELAND, OHIO, the price is still less. We most cordially commend this book for the use of farmers.

Whatever form is used for a Day-Book, a Ledger should also be kept. This is not an absolute necessity, but it is a very great convenience—so great as to be almost indispensable. Concerning this book, HON. H. M. SPALDING, in "HOW TO BE YOUR OWN LAWYER," says: "For each person who becomes indebted to us, or to whom we become indebted, an account is opened in this book, and the date and amount of such indebtedness therein recorded, so that however numerous the transactions that we have with an individual may be, or however widely separated as to time, they are all brought together within a very small space under his account in the Ledger, where the amounts can be readily seen, and whether we owe him, or he owes us, and how much, easily determined.

"By thus bringing compactly together all the transactions which we may have with an individual, spread over, it may be, many months, and arranging upon one side of his account all items for which he becomes indebted to us (that is, for which he owes us), and upon the other side all items for which we become indebted to him (that is, for which he trusts us), we make it an easy matter to quickly determine at any time the difference, or balance as it is termed, and whether it be in our favor or

against us. The balance is in our favor when the Dr. side exceeds the Cr., that is, when he owes us more than he trusts us; and against us when the Cr. exceeds the Dr., that is, when he trusts us more than he owes us."

The Ledger should be ruled so that the Dr. and Cr. accounts with an individual can be kept on a single page. The Dr. items should occupy the left-hand side, and the Cr. items should appear on the right.

Once in six or twelve months all the accounts in the Ledger should be balanced. This is done by adding both the Dr. and the Cr. columns, subtracting the smaller from the greater, and using the remainder as the beginning of a new account.

No scratching or erasing of any kind is allowable in the account-books. If a mistake is made a statement of the fact, with an explanation of the same, should be interlined. Blotting or scratching out an account, or a single entry in an account, will injure, and perhaps utterly destroy, the value of the books as evidence in court. If the entries in the Day-Book are made *promptly* and the Ledger is kept well up to date there will be little danger of making mistakes.

Professional book-keepers, and merchants doing a large business, keep more books than we have named. A Journal and Cash Book are usually kept, but we do not think them necessary for the farmer. It is important to have the whole system as simple as possible. If the farmer wishes a more minute description of his business he can add the desired departments in the books already mentioned. But these, if properly kept, will enable him to determine just what he sells, and the amount of money received from his farm each year, and show him just where the money which he has paid out has gone, and for what it has been given. Such knowledge must be of incalculable advantage.

In order to obtain the full benefit of the course advised the farmer should take an inventory of his property once each year. This may be done at any time, but the first of January or the first of April will be the best. On one side of this inventory account should be placed the Resources and on the other the Liabilities of the farmer. The former include all his property—land, buildings, live-stock, hay, grain, tools, all dues on unsettled accounts, cash on hand, and any and every style of property which he may own. These different kinds of goods should be specified, and their cash value given. The Liabilities include all borrowed capital, such proportion of his interest, taxes, and insurance, as is due when the inventory is taken, all dues to others on accounts, and all debts of any and every kind. If the Resources exceed the Liabilities the difference will be the sum which the farmer is worth. If the balance is on the other side of the account, the figures will show how much he is in debt in excess of his means of payment. A comparison of these papers year by year will show him whether he is making or losing money, and how fast. This inventory should never be neglected, as it is the only means by which the farmer can accurately tell whether he is making or losing money. He may have a great deal more cash on hand one year than he had at the same period of another year, and yet be much poorer than he was then. At one time he has money, while at the other he had a greater value in hay, grain, and live-stock. The inventory alone can determine this very important point.

Against one mistake which farmers are very likely to make we wish to caution our readers. If after paying their bills and balancing their accounts for the year they have nothing left, they say that they "have not made a cent." Evidently they have a very imperfect idea of what profit really is. They have placed on one side of the account all the receipts from the farm, and on the other all the expenses not

only of the farm *but also of the family*. The former expenses are legitimate. They should be compared with the receipts, and from this comparison a balance should be struck. But the expenses of the family are no more to be charged to the farm than is the cost of the improvements which the GOVERNMENT has been making in the mouth of the MISSISSIPPI RIVER. The fact that the expenses of the farm have been paid, *and* the family supported, is proof that the farm has paid quite a profit. *The family has been supported wholly from the profits of the farm.* The merchant who keeps even with the world and pays all his bills may not lay up money, but he would not think of saying that he was making nothing. If he were not making money he could not support his family without increasing his debts. The same principle fully applies to the farm. There *must* be a profit over and above the legitimate expenses or else the farmer cannot meet his bills.

We hope the day will soon come when the simple principles of book-keeping will be taught in the public schools, and when every farmer will keep careful accounts with all individuals with whom he does a credit business, with his crops, his fields, and his stock, and an accurate record of all the money received and paid. The amount of time and labor required is much smaller than those who have never tried the plan suppose, while the resultant benefits are abundant and permanent.

FALSE ECONOMY.

ECONOMY is a virtue which brings its own reward. It is at the foundation of all permanent success in the various productive industries. The man who depends upon his labor for his support and for maintaining his family must practice it or fall far short of his desires. But while this virtue is one of the indispensable requisites to success, it is, like all other good things, often counterfeited, and by reason of the miserable quality of the imitations the genuine virtue has often fallen into discredit. The farmer should avoid the spurious economy as carefully as he should practice the genuine. True economy consists in using things to the best advantage, and avoiding waste of every kind. False economy takes unto itself many forms. A few of the principal ones will be briefly noticed.

The farmer who "cannot afford" to buy books, and take papers which are specially designed to help him in his work, is practicing a false economy. The captain who should start on an ocean voyage without a compass because he did not feel able to purchase one would be considered a lunatic. The lawyer who should try to get along without a library because books cost money which he did not want to spare would never succeed. The doctor who used no books and read no papers devoted to his profession would ruin himself and the few patients who might employ him. In all kinds of business knowledge is one of the great essentials to success. The farmer who has books and papers devoted to his work has an immense advantage over his neighbor who has neither of these aids. One man plods on alone while the other has the recorded experience of many successful farmers, and the results of an immense amount of hard study and close observation to help him. Instead of saying that he cannot afford to purchase these aids the farmer should feel that he cannot afford to do without them.

The farmer who does not feel able to obtain good stock is making a great mistake in his desire to be economical. By this we do not mean that he ought to buy

thorough-bred animals, but that he should keep the very best of his calves and lambs, and try to steadily improve the quality of his stock. The man who sells his best stock to the butcher and keeps the poorest for breeding is on the direct road to financial ruin. If all the departments of his business were managed on the same principles he would soon be obliged to give up his farm.

Letting things run at loose ends for want of time in which to attend to them is another way in which many farmers falsely economize their time. They do not keep accounts with their crops because it is "too much work," and for the same reason they often neglect to make a note of their business transactions with their neighbors. In each case they are losers by their effort to save time and labor. They do not hoe their corn as early as they should, and the ground is filled with weeds. In the fall they are busy, and their wheat is not sown until late. When they find time to do the work the season is so far advanced that the seed is hurried into land which is poorly prepared, and a poor crop for the next year is fully insured. These men are always busy, yet they do not truly economize their time because they are always a little behind in their work. Promptness is always necessary to the practice of economy, and to the attainment of success.

Buying the necessities of life in very small quantities is another manner in which many people try to be economical but are really extravagant. Things which are in constant use in a family, and which cannot be produced at home, can be bought much cheaper in large than they can in small quantities. Better pay a dollar and twenty cents for a dozen papers of starch at one time than to keep running to the store every little while for a single paper, and paying twelve cents for it. Unless made at home, soap should be bought by the box. Buy ten gallons of oil at a time, and purchase thread by the dozen spools. Many such things can be bought much cheaper in this way than they can in the usual manner, and there will be a great saving of time now spent in running to the store, as well as the avoiding of a great deal of inconvenience caused by being out of things which are needed for immediate use.

Buying goods on credit is another way in which many farmers lose in attempting to save their money. It is often a convenience to obtain a little time on purchases, but it should be sought only as an accommodation, and not made a common practice. It is better for the farmer to borrow money to meet his running expenses during those seasons in which he has but little income, than it is to run up a long bill at the store. He will have to pay interest on the account if he gets trusted, and the rate per cent. will not be less than the money-lenders charge, while the price of the goods will be considerably higher than he would have to pay if he bought for cash.

The purchase and use of poor tools because they are cheap, is one of the falsely economical methods which are often pursued. Better pay a hundred dollars for a good wagon than seventy-five dollars for an inferior one. The good one will last as long as two of the poor ones, and not involve half as much expense for repairs. A good cultivator, or harrow, or plow, which is well made and which will do thorough work, is worth more than three times as much as an inferior one which is poorly built, and with which it is impossible to do good work. The difference in the yield of a single crop on two or three acres of land would often more than pay the difference in price between a good and a poor pulverizer. The man who chops with a poor axe, digs with a poor shovel, pitches hay with a poor fork, or uses poor tools for any other purpose, works at a great disadvantage, and is practicing a thoroughly false economy.

Another mistake in the same direction is made by farmers who grow bulky crops for which there is no home market, and upon which heavy transportation charges must be paid. The farmer who sends his hay a long distance to market could almost always do a great deal better to feed it to cattle and sheep, as he could send the animal products to market in a much smaller space than the hay would occupy. The farmer should not be satisfied with an economy which merely allows no direct waste. He should look farther than this, and see that everything is used to the best possible advantage. It should not be enough that cattle and hogs eat all of his hay and grain, but the hay and grain should be fed to that class of animals which will yield the highest percentage of profit. It is not enough that he keeps all of his land under cultivation. This is well as far as it goes, but in addition to this he should grow those crops which will pay him the best for his time and labor. The same principle should govern in all departments of his business.

Buying things which might easily and profitably be grown at home is an expensive error into which many farmers are led by a false economy. This subject has already been treated, but it deserves mention in this connection. Many a farmer has thought that he could not afford to grow corn at the prices then ruling in market, and has grown something else and bought corn. Finding the crop which he selected was not paying him well he has changed to another, and has kept changing, with injury to his business every time, until he has lost faith in almost all special crops if not in the whole business of farming. The idea that the farmer must grow only two or three articles, sell them, and with the money thus obtained buy everything which his family consumes, is a pernicious one, and many men have been financially ruined by putting it into practice. As the NATIONAL LIVE-STOCK JOURNAL has well said: "The tendency of this practice is to make every farmer a trader, who sells everything he produces, and buys everything he consumes, by which he becomes dependent upon the whims and fluctuations of the markets at both ends of his business." What he sells must go at wholesale rates, but for all that he buys he must pay retail prices. If he would produce all the articles possible instead of buying them, he could obtain them at cost, and thus make a great saving of expense.

Doing without scales and measures and "guessing" at the weight of articles bought and sold, and of crops produced, is one of the ways in which a false economy is practiced. Every farmer ought to have some accurate scales with which he can weigh his farm products and test the yield of his cows. Many a man is deceived in regard to the value of his cows because he has nothing with which to weigh their milk and the butter which is made therefrom. For weighing pigs, calves, and lambs, determining the actual and relative gain of different animals, ascertaining the quantity of wool produced by each sheep, and many other purposes, scales are not only useful, but are almost invaluable to the farmer. A good set of measures is also required. These measures are not only convenient, but they are often absolutely necessary to anything like an accurate knowledge of the yield of crops and the relative production of different fields.

The last error of this class which we shall name is the habit of depending upon others for doing what could just as well be done at home. Many a job goes to the harness-maker which the farmer could do if he would try. With a few tools, and at a merely nominal expense for materials, a farmer of common ingenuity can do many little jobs in the way of repairing tools which are now sent away to be performed, and which, in the aggregate, cost quite a sum of money. In this way there

would be a direct saving of expense and of much valuable time. It will pay well to keep a few tools and a small stock of suitable materials for repairs constantly on hand. The boys should be encouraged to try their skill at the work, and thus form a good habit and obtain experience which will be very useful to them in after life.

A GOOD REPUTATION.

IN order to obtain the highest degree of success the farmer must obtain a good reputation. This should be built upon the solid basis of a thoroughly good character, and should be sought because it is a duty to secure and retain such a character. The financial advantages which come with a good name are to be considered as incidentals. They are legitimate and valuable, and ought to be prized and used. The farmer should do right *because it is right*, and not for the hope of reward; but when he has done right he is fairly entitled to the benefits which such a course confers. Yet many farmers, through carelessness or neglect, make no effort to secure a good reputation. Some who deserve such an honor do not receive it because they do not value it and take no pains to secure its advantages. Many others strive to obtain the benefits without complying with the conditions. But in the long run all shams will fail. Trickery and deceit may not be discovered at once, but the time will come when they will be exposed. The only right course, and the only one which will be permanently successful, is to be strictly honest in all business transactions.

Many illustrations of the value of a good reputation might be given, but it is probable that every reader can find one, or more, in the circle of his own acquaintances. We will only allude to two cases, both of which are widely known. MR. WARING, of OGDEN FARM, has long been engaged in manufacturing JERSEY butter and breeding JERSEY cattle. The butter has been of uniform quality and of the very highest grade. Customers who bought it were confident that it would be first-class. The fact that it came from OGDEN FARM was all the recommendation they required to induce them to pay a dollar a pound. The live-stock always proved as represented, and customers knew that they should be fairly dealt with. A large business has been established, and, at a recent valuation of the farm and other property, the "good-will" was estimated at ten thousand dollars. The other illustration is furnished by MR. ROBERT L. PELL, the "prince of apple-growers." He has an orchard of over twenty thousand trees of the NEWTOWN PIPPIN variety. This orchard has been managed with a great deal of skill and produces a splendid quality of fruit. The apples are carefully picked, passed through the sweating process, assorted, and the perfect specimens placed in boxes containing one hundred apples each. These are shipped to LIVERPOOL and sold at auction. For forty years this plan has been pursued, and the fruit is so well known, and the reputation of MR. PELL is so firmly established, that sales are readily effected at extremely high prices. Buyers know that MR. PELL never sends an inferior apple.

It is not expected that the average farmer can achieve as great a degree of success as the above examples show, but it is certain that he can obtain a reputation which will prove a great help in his business. Only two things are necessary to secure this. These are strict and careful honesty, and the use of his name. The man who *never* mixes small potatoes with the large ones, who sends just as good apples in the

middle of the barrels as he does at each end, who never puts a stick of inferior wood into a load which he sells for first-class, whose loads of good hay are good in the centre as well as at the top and bottom, whose measurements of grain and vegetables are always accurate, and whose packages of butter are always full weight—in short, a man who *never* deviates from the strict letter and spirit of CHRISTIAN honesty—such a man can easily obtain a reputation which will make a demand for all the farm products which he can supply. His customers will be fully and always satisfied, and will be willing to pay an extra price for his goods. If he puts his name upon every package of goods, customers will seek him, and he will lose no time in making sales. Every man *ought* to furnish such goods (or when selling the lower grades plainly mark them as inferior, and reduce the price) *because it is right*. Those who are not particular about the principle of the transaction will find it profitable to adopt this method. “Honesty is the *best* policy” for all men, though men ought to be honest from a higher motive than prudence. There are, in all, a great many farmers who do not mean to be actually dishonest, but who are careless and thoughtless, and whose products are not always first-class. They would find it greatly for their own interest, and their customers would be highly pleased with the new arrangement, to make a radical change in their methods and grade their products with a greater degree of care.

The farmer should have a stencil-plate, and a butter-stamp, with which he can mark his name upon every package of goods which he sells. He should also have a plate and stamp with which the grade of the goods can be plainly indicated. Every barrel of his best apples should bear his name, and the words FIRST-GRADE should be printed in a conspicuous place. The barrels containing slightly inferior specimens should have his name and be marked SECOND-GRADE. The balls, or tubs, of butter which he carries to market should also be plainly marked with his name and their appropriate quality. All other products which are sold in packages should bear his name and their proper grade.

The cost of building up a good reputation is small. The advantages are great. The truly honest man who is guided by CHRISTIAN principle will have no difficulty in complying with the conditions upon which success depends, and in securing the advantages which it insures, while the man who has been governed by no higher motive than policy can find in this principle an efficient aid in overcoming the obstacles with which he is obliged to contend.

INSURANCE.

WHAT man is a “creature of circumstances,” and liable to many ills which he cannot foresee and from which he cannot escape, every one who has had experience in the things of this world will readily acknowledge. Revelation, reason, and common-sense, enforced by the experience of mankind in all the past ages, all unite to teach that trouble of various kinds will surely come to all the children of men. And the evil is much more formidable than it would be if we knew the time and manner in which the ills would come. That they *will* come we may rest assured, but the time of their approach no one can determine.

While there are many evils to which the race is of necessity subjected there are others which cause a great deal of suffering, but which are easily preventable.

Ignorance and carelessness are the parents of a multitude of ills which afflict mankind. In these instances the suffering is merely the penalty of a violated law. The fact that the law is not understood makes no difference with the results of transgression. The man who throws a heap of greasy woollen rags on his barn-floor may never have heard of spontaneous combustion, but his buildings will be just as likely to be burned as they would if he knew that he was practically setting them on fire. The man who thoughtlessly steps in front of a moving train of cars will be injured just as severely as he would if the deed had been premeditated. The smoker who throws a lighted match upon a barn-floor may not design to do the slightest harm, but if the barn is burned by his carelessness the loss of the owner is just as severe as it would have been if an incendiary had deliberately applied the torch. And in these ways of ignorance and carelessness a vast amount of property and many valuable lives are annually lost. The remedies for this class of evils is plain. Education and thoughtful care would do them almost wholly away.

There is another class of ills which come upon mankind without direct reference to the deeds of the sufferers. Certain kinds of accidents from which men suffer are wholly beyond their individual control. The passenger in a fated railroad train has no power to avert disaster, but he must suffer the natural consequences of the accident. Houses and barns may be burned without any fault of the owner. Death is sure to come to each and every one. When and how no one knows, but sooner or later he will appear to each individual of the race and remove him from his earthly place and work. Although the individual cannot prevent the coming of death, or accident, or the destruction of property by fire, he does have, to some extent, the power of self-protection against many of the evil results of these events. Death will take him from his family, accidents which he cannot prevent may disable him, and his buildings may be burned. When these things come upon him he must endure them, but if he has been wise in season he can avail himself of certain compensations which will make these troubles much easier to be borne. By using the proper means a partial remedy for these ills may be secured, and the severity of the trials of life may be greatly mitigated.

Under certain forms INSURANCE has existed, as a remedy for the ills we have mentioned, for a long period. During the past fifty years the system has been greatly improved and a large increase in the amount of business has been effected. Numerous companies have been formed. A few of these have proved unworthy of confidence and involved their patrons in loss and disappointment. But this fact is not an argument against insurance. The good is always counterfeited. Therefore, it is not strange that miserable insurance companies should have been formed. The stringent times which have prevailed for a few years have sifted out these weak and worthless claimants for popular favor, and the LEGISLATURES of most of the States in which insurance companies are located have passed such stringent laws, and put the managers under such close and careful watch, that there is now but little chance for them to do any mischief if they desire, while most of the leading companies are managed by honest and honorable men, who have both reputation and money at stake, and who are constantly seeking the best good of their policy-holders. These companies have gone steadily on, paying all losses promptly, and fulfilling all their contracts. They are now on as firm a basis as any business or any institution in the world.

To the majority of men who have families depending upon them for support LIFE INSURANCE is a safe and easy way in which to provide for an event which will cer

tainly occur some time, and which may take place any hour. This form of insurance covers a great risk. The managers of a company know that a few of their policy holders will die each year, but they do not know *which ones*. Every policy holder knows that some of the number insured will soon die, but he cannot tell whether *he* will be called or not. If he lives he can make the requisite payment without much difficulty, and it will help pay the families of those who do not survive. If he is called away *his* family will receive the benefits which life insurance confers. The companies carry the same risk for each and every man whom they insure. If he lives they receive the premiums, if he dies they pay the policy. If a man dies after paying only one premium his family receive a large sum from a very small investment. If he lives many years, and pays a great deal for his insurance, the money is safely invested, and, when he dies, the family will find that it has been truly saved for their benefit.

FIRE INSURANCE.—This form of insurance covers the risk of the destruction of buildings by fire. It has been quite extensively employed, and its principles commend it strongly to every owner of this kind of property. While it is true that the fires by which a great many buildings are destroyed are caused by the neglect or carelessness of some one on the premises, it is also true that in many of these instances, in which the owner was not to blame, the companies pay the policies in full. It is expected that many buildings will be burned, and the rate of insurance is fixed with this fact in view. Of course, the companies will not hold out an inducement for a man to be careless. They will not make good *all* the damage caused by fire if his buildings are consumed. But they will insure the buildings at from one-half to three-fourths of their value and pay all honest claims under such a contract.

While the greatest care should be taken to prevent the burning of buildings, the risk that they will be destroyed by fire, even under the most careful management, is so great that none except wealthy farmers should carry that risk themselves. The sum required for keeping an ordinary set of farm buildings insured for one-half their value is quite small and ought to be cheerfully paid. If a farmer is poor, and has to work hard to support his family, he *ought* to keep his buildings constantly insured. In his case insurance is a *duty*. He is badly enough off now. But if he were to lose his buildings without insurance he would be financially ruined. If a rich man prefers to run the risk of fire rather than pay for keeping his buildings insured he has a right to do so. If his buildings are burned he can erect new ones without distressing his family, his neighbors, or himself. But with a poor man the case is different. Only by the help of neighbors and friends will it be possible for him to rebuild, and he may even lose possession of his mortgaged farm. He will be dependent upon charity when he ought to have a valid claim upon a good insurance company. In many cases neighbors have given money enough to build a new house, but this is a heavy tax upon neighborly kindness. These neighbors have been paying out money year after year to keep their own buildings protected, and they think it hard to have to build new ones for a man who refused to incur the slight expense which would have been involved in keeping his old ones insured. The poor man has no moral right to allow his buildings to remain without insurance and then call on his neighbors to make good his losses when they are burned. Every farmer is able, and he ought to be willing, to keep his buildings insured. As farm buildings are frequently quite a distance from a village there is little hope of saving them if a fire is started. There is no fire company near, but little water

is at hand, and but few people to use it. Too often both the buildings and most of their contents are destroyed. Consequently, the greatest care should be used to prevent an outbreak, and an insurance policy should constantly be kept in force.

ACCIDENT INSURANCE.—The principle upon which this business is conducted is similar to that of life insurance. Carefully selected statistics have proved that for each thousand men engaged in any particular calling a certain number of accidents, averaging a certain degree of severity, will occur. The expense of insurance is proportioned to the risk to which each class is exposed. It costs a farmer only ten dollars a year to obtain an accident policy which will secure to him a weekly indemnity of five dollars during the period of total disability from accident, if the time does not exceed six months, or to his family one thousand dollars in case of fatal injury. Such a policy covers the risk of injury from a multitude of causes to some of which the farmer is almost constantly exposed. The risk is so great, the cost of insurance so small, and the help which such a policy gives is so timely, that it seems to be wise for every farmer to keep insured, so that in case of accident the enforced idleness will not prove a total loss.

We are well aware that to keep up the various forms of insurance which have been named requires frequent payments and involves considerable expense. But we believe that the man who desires to secure a competence, and leave his family beyond the reach of want, will be unwise, perhaps criminally so, if he neglects by means of insurance to provide for contingencies which may occur at any time, and which, occurring in the early part of his married life without such a safeguard, will involve him in financial ruin or his family in life-long distress. Insurance is based upon the principle that about a certain rate of mortality, and a certain number of casualties will occur under certain given circumstances, and that the many belonging to the classes which are thus exposed should combine for self-protection. By a small payment on the part of each of the insured, the few who are the losers may be indemnified, or their families may receive the help which they need. Insurance finds its strongest advocates among men of CHRISTIAN principle, and is one of the most effectual means which GOD has given to intelligent men by which they can guard against disasters and provide for families which otherwise might be left without adequate means of support.

USEFUL TABLES.



WE have carefully collected the following tables from various sources, including WARING'S FARMERS' AND MECHANICS' MANUAL, MOORE'S UNIVERSAL ASSISTANT, HASWELL'S CIVIL ENGINEERS' POCKET COMPANION, and the leading papers. It is often very desirable to know the relative value of different kinds of food for animals, the quantity of seed required to stock a given area of land, the number of trees on an acre at given distances apart, the capacity of boxes, the number of nails in a pound, the weights of different kinds of soils, the method of finding the weight of hay in a mow or stack, the number of bushels of grain in a bin, and many other things which are clearly shown in the following tables. The advantages of the information therein conveyed will be appreciated by all who are dissatisfied with the uncertain results of the "guessing," which is too often the only guide in making the estimates required in the practical business of the farm.

QUANTITY OF HAY, OR ITS EQUIVALENT, REQUIRED PER DAY BY EACH 100
POUNDS OF LIVE WEIGHT OF VARIOUS ANIMALS.

Working Horses.....	3.8 lbs.	Young Cattle.....	3.8 lbs.
Working Oxen.....	2.41 "	Steers.....	2.84 "
Fattening Oxen.....	5. "	Pigs.....	3. "
Milch Cows.....	2.25 to 2.40 "	Sheep.....	3. "
Dry Cows.....	2.42 "		

RELATIVE VALUE OF FOODS FOR CATTLE.

100 lbs. of GOOD HAY is supposed to	be equal to	276 lbs.....	Carrots.
400 lbs.....	Green Clover.	54 "	Rye.
275 "	Green Corn.	45 "	Wheat.
374 "	Wheat Straw.	54 "	Barley.
442 "	Rye Straw.	57 "	Oats.
195 "	Oat Straw.	59 "	Corn.
400 "	Dry Corn *Stalks.	69 "	Linseed Cake.
		105 "	Wheat Bran.

The age, health, and condition of animals, and the care which they receive, will greatly modify the effect of any kind of food. Cattle also need a variety of food, and cannot be profitably kept upon any one sort for a long period of time.

AGE FOR REPRODUCTION, AND PERIOD OF GESTATION OF DOMESTIC ANIMALS.

Stallion.....	Age 5 years.....	Duration of Power. .	Mean Period of Gestation.
Mare.....	4 "	10 " 12 "	347 days.
Bull.....	3 "	8 " 10 "	
Cow.....	3 "	10 " 14 "	283 "
Ram.....	2 "	7 "	
Ewe.....	2 "	6 "	154 "
Boar.....	1 "	6 "	
Sow.....	1 "	6 "	115 "
Dog.....	2 "	8 to 9 "	
Bitch.....	2 "	8 " 9 "	60 "
He-Cat.....	1 "	9 " 10 "	
She-Cat.....	1 "	5 " 6 "	50 "

GROWTH AND LIFE OF ANIMALS.

Man.....	Grows for 20 years, and lives.....	70 to 100
Horse.....	" " 5 " " "	25 " 40
Ox.....	" " 4 " " "	15 " 20
Dog.....	" " 2 " " "	12 " 14
Cat.....	" " 1½ " " "	9 " 10
Swine.....	" " 2 " " "	10
Sheep.....	" " 2 " " "	10

QUANTITY OF SEED PER ACRE.

Wheat.....	1¼ to 2 bushels	Rice.....	2 to 2½ bu.
Barley.....	1½ " 2½ "	Broom Corn.....	1½ " ¼ "
Oats.....	2 " 4 "	Potatoes.....	5 " 10 "
Rye.....	1 " 2 "	Timothy.....	12 " 24 quarts
Buckwheat.....	¾ " 1⅓ "	Mustard.....	8 " 10 "
Millet.....	1 " 1½ "	Herds Grass.....	12 " 16 "
Corn.....	¼ " 1 "	Flat Turnip.....	2 " 3 lbs.
Beans.....	½ " 1½ "	Red Clover.....	10 " 16 "
Peas.....	2½ " 3½ "	White Clover.....	3 " 4 "
Hemp.....	1 " 1½ "	Blue Grass.....	10 " 15 "
Flax.....	½ " 2 "	Orchard Grass.....	20 " 30 "

QUANTITY OF SEED PER ACRE IN ROWS.

Indian Corn.....	$\frac{1}{4}$ to 1 bush.	Onions.....	4 to 5 lbs.
Broom Corn.....	$\frac{1}{8}$ to $\frac{1}{4}$ "	Carrots.....	2 to 2½ "
Beans.....	$\frac{1}{2}$ to 1½ "	Parsnips.....	4 to 5 "
Peas.....	1½ to 2 "	Beets.....	4 to 6 "

STANDARD WEIGHTS OF GRAIN PER BUSHEL.

Wheat.....	60 lbs.	Oats.....	32 lbs.
Rye.....	56 "	Barley.....	48 "
Corn.....	56 "		

QUANTITIES OF GARDEN SEEDS REQUIRED TO PLANT A GIVEN SPACE.

Asparagus 1 oz. produces 1000 plants and requires a bed
12 feet square.

" Roots... 1000 plant a bed 4 feet wide and 225 feet long.

Beans, large pole... 1 quart plants 100 hills.

" small " ... 1 " plants 300 hills.

Beets..... 1 oz. plants 150 feet of row.

Cabbage..... 1 oz. produces 2500 plants.

Carrot..... 1 oz. plants 150 feet of row.

Celery..... 1 oz. produces 700 plants.

Cucumber..... 1 oz. for 150 hills.

Lettuce..... 1 oz. produces 7000 plants.

Melon, Musk..... 1 oz. for 120 hills.

Onion..... 1 oz. for 200 feet of row.

Parsnip..... 1 oz. for 250 feet of row.

Peas..... 1 quart for 120 feet of row.

Radish..... 1 oz. for 100 feet of row.

Squash..... 1 oz. for 75 hills.

Tomato..... 1 oz. produces 2500 plants.

Turnip..... 1 oz. for 2000 feet of row.

Watermelon..... 1 oz. for 50 hills.

LEGAL WEIGHT OF GRAIN, SEEDS, AND VEGETABLES IN DIFFERENT STATES.

	N. Y.	Ohio.	Pa.	Ind.	Wis.	Iowa.	Ill.	Mich.	Conn.	Mass.	R. I.	Ky.	N. J.	Vt.	Mo.	Canada.
Wheat.....	60	60	60	60	60	60	60	60	56	60	..	60	60	60	60	60
Rye.....	56	56	56	56	56	56	54	56	56	56	..	56	56	56	56	56
Corn.....	58	56	56	56	56	56	56	56	56	56	..	56	56	56	52	56
Oats.....	32	32	32	32	32	35	32	32	28	32	..	33	30	32	m	34
Barley.....	48	48	47	48	48	48	44	48	..	46	..	48	48	46	m	48
Buckwheat.....	48	..	48	50	42	52	40	42	45	46	..	52	50	46	m	48
Clover Seed.....	60	64	..	60	60	60	..	60	..	..	..	60	64	..	m	60
Timothy Seed.....	44	42	..	45	..	45	..	m	..	m	..	45	..	..	m	48
Flax Seed.....	55	56	..	56	..	56	..	m	..	m	..	56	55	..	m	56
Hemp Seed.....	44	..	..	44	..	44	..	..	..	..	..	..	..	..	..	..
Blue Grass Seed.....	14	..	..	14	..	14	..	..	..	..	..	..	..	..	..	..
Dried Apples.....	22	25	..	..	28	24	..	28	..	..	..	..	..	..	..	22
Dried Peaches.....	32	33	..	..	28	33	..	28	..	..	..	..	..	..	..	22
Potatoes.....	60	..	..	60	..	60	..	..	60	60	60	..	..	60	..	..
Peas.....	60	..	..	..	..	..	..	..	..	60	..	..	..	..	..	60
Beans.....	62	56	..	60	..	60	..	..	..	60	..	60	..	..	..	60
Castor Beans.....	46	..	..	46	..	46	..	..	..	..	..	..	..	..	..	..
Onions.....	57	..	..	57	..	57	..	..	..	50	50	..	..	..	..	..
Corn Meal.....	..	..	..	50	..	..	..	..	..	..	50	..	..	..	..	..

The letter "m" indicates that the article is sold by measure instead of weight. In many of the States there is no law regulating the weight of farm products.

NUMBER OF SEEDS IN A BUSHEL, AND NUMBER PER SQUARE FOOT IF USED ON AN ACRE OF LAND.

No. of Seeds.	No. Per Foot.
Timothy, 41,823,360.....	960.
Clover...16,400,960.....	376.
Rye..... 888,390.....	20.4.
Wheat... 556,290.....	12.8.

NUMBER OF LOADS OF MANURE PER ACRE, AND OF HEAPS PER LOAD, REQUIRED WITH THE HEAPS AT GIVEN DISTANCES APART.

Distance Apart of Heaps—in Yards.	No. of Heaps Per Load.				Distance Apart of Heaps—in Yards.	No. of Heaps Per Load.			
	3	4	5	6		3	4	5	6
3	179	134	108	89½	5	64½	48½	38¾	32¼
4	101	75½	60½	50½	6	44¾	33½	27	22½

In the above table the distances apart of the rows and the heaps in the rows are given in the left hand column. The number of heaps to be made of each load is placed at the top of the columns, and the number in the square where the two meet will give the number of loads per acre which will be required. Thus, if the heaps are placed four yards apart, and five heaps are made of each load, it will take sixty and a half loads for an acre.

NUMBER OF TREES, PLANTS, OR HILLS ON AN ACRE.

Ft. Apart.	No. of Plants, etc.	Ft. Apart.	No. of Plants, etc.	Ft. Apart.	No. of Plants, etc.	Ft. Apart.	No. of Plants, etc.
40x40	27	28x28	55	16x16	171	4x4	2722
39x39	28	27x27	59	15x15	194	3x3	4840
38x38	30	26x26	64	14x14	223	3x2½	5808
37x37	31	25x25	70	13x13	258	3x2	7260
36x36	33	24x24	75	12x12	302	3x1½	9680
35x35	35	23x23	82	11x11	360	3x1	14530
34x34	37	22x22	90	10x10	436	2x2	10890
33x33	40	21x21	99	9x9	538	2x1½	14496
32x32	42	20x20	109	8x8	680	2x1	21780
31x31	45	19x19	121	7x7	889	2x½	43560
30x30	48	18x18	135	6x6	1210	1x1	43560
29x29	51	17x17	151	5x5	1742	1x½	87120

AREA OF LAND which a team, moving two miles per hour, will plow in a day ten hours in length.

Width of Furrow.	Acres.	Width of Furrow.	Acres.
5.....	1	10.....	2
6.....	1.2	11.....	2.2
7.....	1.4	12.....	2.4
8.....	1.6	14.....	2.8
9.....	1.8	16.....	3.2

RULE FOR FINDING THE NUMBER OF TONS OF HAY IN A MOW.

Multiply the length in yards by the height in yards, and that by the width in yards, and divide the product by fifteen.

The quotient will be the number of tons.

RULE FOR FINDING THE NUMBER OF BUSHEL OF GRAIN IN A BIN.

Multiply the length in inches by the breadth in inches, and that by the depth in inches, and divide the product by 2150 (the number of cubic inches in a bushel), and for heaped bushels by 2748, and the quotient will give the number of bushels.

RULES FOR MEASURING CORN IN THE EAR IN CRIBS.

Multiply the length in inches by the breadth in inches, and that by the height in inches, and divide the product by 2748 (the number of cubic inches in a heaped bushel), and the quotient will be the number of heaped bushels of ears. Take two-thirds of the quotient for the number of bushels of shelled corn. Unless the corn is very good only one-half should be taken.

Another Rule.

Multiply length by height, and then by width, add two ciphers to the result, and divide by 124. This gives the number of bushels of ears (level measure). Divide by two to find the number of bushels of shelled corn.

Another Rule.

Multiply the length, breadth, and height together in feet to obtain the cubic feet. Multiply this product by 4, and strike off the right hand figure, and the result will give very nearly the number of bushels of shelled corn.

CAPACITY OF BOXES.

Length.	Width.	Depth.	Capacity.
24 inches.....	16 inches.....	28 inches.....	5 bushels.
24 ".....	16 ".....	14 ".....	2½ ".....
16 ".....	16 ".....	8.4 ".....	1 ".....
16 ".....	8.4 ".....	8 ".....	½ ".....
8 ".....	8.4 ".....	8 ".....	¼ ".....
8 ".....	8 ".....	4.2 ".....	1 gallon.
7 ".....	4 ".....	4.8 ".....	½ ".....
4 ".....	4 ".....	4.2 ".....	1 quart.

TO REDUCE CUBIC FEET TO BUSHEL, struck measure, divide the number of cubic feet by 56 and multiply by 45.

MISCELLANEOUS WEIGHTS AND MEASURES.

196 lbs. 1 barrel of flour.	44 lbs. 1 barrel of hemp seed.
200 " 1 " " beef, pork, or fish.	12 units or things 1 dozen.
280 " 1 " " { salt at N. Y.	12 dozen 1 gross.
" 1 " " { salt works.	20 things 1 score.
60 " 1 bushel of beans.	56 pounds 1 firkin of butter.
14 " 1 " " blue grass seed.	24 sheets of paper 1 quire.
46 " 1 " " castor beans.	20 quires of paper 1 ream.
60 " 1 " " clover seed.	4 feet wide, 4 feet high, } . . . 1 cord of
56 " 1 " " flax seed.	and 8 feet long, } wood.

COMMERCIAL WEIGHTS.

16 drams 1 ounce.	4 quarters 1 hundred weight.
16 ounces 1 pound.	20 hundred weight 1 ton.
25 pounds 1 quarter.	

A CONVENIENT LAND MEASURE.

To aid farmers in arriving at accuracy in estimating the amount of land in different fields under cultivation, the following table is given.

Five yards wide by 968 long contains one acre; ten yards wide by 484 long contains one acre; twenty yards wide by 242 long contains one acre; forty yards wide by 121 long contains one acre; seventy yards wide by $69\frac{1}{2}$ long contains one acre; eighty yards wide by $60\frac{1}{2}$ long contains one acre; sixty feet wide by 726 long contains one acre; one hundred and ten feet wide by 397 long contains one acre; one hundred and thirty feet wide by 363 long contains one acre; two hundred and twenty feet wide by $181\frac{1}{2}$ long contains one acre; four hundred and forty feet wide by 99 long contains one acre.

LAND MEASURE.

144 square inches.....	1 square foot.	40 square rods.....	1 square rood.
9 square feet.....	1 square yard.	4 square roods.....	1 square acre.
$30\frac{1}{4}$ square yards.....	1 square rod.	640 square acres.....	1 square mile.

LONG MEASURE.

12 inches.....	1 foot.	3 miles (measuring at sea)...	1 league.
3 feet.....	1 yard.	6 feet (depth of water)....	1 fathom.
$5\frac{1}{2}$ yards, or $16\frac{1}{2}$ feet.....	1 rod.	4 inches (horse measure)....	1 hand.
320 rods, or 1,760 yards, } or 5,280 feet }	1 mile.		

LIQUID MEASURE.

4 gills.....	1 pint.	$31\frac{1}{2}$ gallons.....	1 barrel.
2 pints.....	1 quart.	63 gallons.....	1 hogshead.
4 quarts.....	1 gallon.		

LENGTH OF CUT NAILS AND NUMBER IN A POUND.

	Length.	Number.		Length.	Number.
3 penny.....	$1\frac{1}{4}$ inches.....	420	10 "	3 inches.....	65
4 ".....	$1\frac{1}{2}$ ".....	270	12 ".....	$3\frac{1}{4}$ ".....	52
5 ".....	$1\frac{3}{4}$ ".....	220	20 ".....	$3\frac{1}{2}$ ".....	28
6 ".....	2 ".....	175	30 ".....	4 ".....	24
8 ".....	$2\frac{1}{2}$ ".....	100	40 ".....	$4\frac{1}{4}$ ".....	20

Nails from different factories vary a little in length and weight.

WEIGHT PER CUBIC FOOT OF DIFFERENT KINDS OF EARTH.

Loose earth or sand.....	95 lbs.	23 cubic feet of sand, }	make one ton.
Common soil.....	124 "	18 " " " earth, }	
Strong soil.....	127 "	17 " " " clay, }	
Chalk.....	174 "	18 cubic feet of gravel or earth before	
Clay.....	135 "	digging make 27 cubic feet when dug.	
Clay and stones.....	160 "		

The weight of an acre of ordinary soil is estimated to be 100 tons for every inch in depth.

WEIGHTS OF DIFFERENT KINDS OF WOOD.

Kind of Wood.	Lbs. Per Cord.	Kind of Wood.	Lbs. Per Cord.
Shellbark Hickory.....	4469	White Pine.....	1868
Redheart Hickory.....	3705	White Beech.....	3236
White Oak.....	3821	Apple Tree.....	3115
Virginia Pine.....	2689	Black Birch.....	3115
Southern Pine.....	3375	White Elm.....	2592
Hard Maple.....	2878	Spanish Oak.....	2449
New Jersey Pine.....	2137	Buttonwood.....	2391
Yellow Pine.....	1904		

The above figures indicate the weight of *seasoned* wood. When green, from

thirty-five to fifty per cent. must be added. A cord of green hickory weighs about six thousand pounds, and a cord of green oak contains more than fourteen hundred pounds of water.

TABLE showing the AMOUNT of one dollar for any number of years from five to twenty years at COMPOUND INTEREST.

Years.	Rate, 5 Per Cent.	Rate, 6 Per Cent.	Years.	Rate, 5 Per Cent.	Rate, 6 Per Cent.
5.....	\$1.27628.....	\$1.33822	13.....	\$1.88564.....	\$2.13292
6.....	1.34009.....	1.41851	14.....	1.97993.....	2.26090
7.....	1.40710.....	1.50363	15.....	2.07892.....	2.39655
8.....	1.47745.....	1.59384	16.....	2.18287.....	2.54035
9.....	1.55132.....	1.68947	17.....	2.29201.....	2.69277
10.....	1.62889.....	1.79084	18.....	2.40661.....	2.85433
11.....	1.71033.....	1.89829	19.....	2.52695.....	3.02559
12.....	1.79585.....	2.01219	20.....	2.65329.....	3.20713

Amount of different sums of money at 7 per cent. COMPOUND INTEREST.

2 cents per day in 10 years will amount to \$	100.85
5 " " " " " " " " " "	252.14
25 " " " " " " " " " "	1,260.71
50 " " " " " " " " " "	2,521.42
1.00 " " " " " " " " " "	5,042.84
2.00 " " " " " " " " " "	10,085.68

TIME in which a sum of money will double at Interest.

Rate Per Cent.	Simple Interest.	Compound Interest.
4.....	25 years.	17 years and 246 days.
5.....	20 "	15 " " 75 "
6.....	16 " and 8 months.	14 " " 327 "
7.....	14 " " 104 days.	10 " " 89 "
8.....	12½ "	9 " " 2 "
9.....	11 " " 40 "	8 " " 16 "
10.....	10 "	7 " " 100 "

The above table should be carefully studied by all who contemplate borrowing money.

Many people think that the interest of money at six per cent. is just twice what it is at three per cent., but figures show that the increase at 6 per cent. for one hundred years is about *eighteen times as rapid* as it is at three per cent. As the growth of National Wealth is only about $3\frac{1}{8}$ per cent. per annum, the farmer *positively cannot afford* to pay very high rates of interest.



HOME LIFE.

CONTENTS OF PART V.

PLEASANT SURROUNDINGS.

LABOR, RECREATION AND REST.

HEALTH AND DISEASE.

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ITEMS FOR THE HOUSE AND FARM.

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PLEASANT SURROUNDINGS.

AS far as possible every man should make his surroundings pleasant. This partly for his own happiness, and for that of his family, and partly because these surroundings will enable them to do better work than they could otherwise perform. Men often lose sight of the fact that they ought to be happy as well as useful in this world. GOD has made the earth beautiful in order that man may enjoy his brief stay upon it. And HE has given man the power to still further beautify and adorn that portion of the world on which he finds his home. It is true that nothing external can fully supply a lack of affection among the members of a household, and that no degree of beauty in the landscape can alone make people happy. But if other things are right, pleasant surroundings prove a never-failing source of joy, while in those cases in which the home life is unsatisfactory they are still more imperatively required.

The condition of their surroundings will have a powerful influence upon the farmer and his family. This influence will be felt at various points. Character, reputation, and appearance will be modified thereby. Unless he has fallen into bad habits it is safe to say that a young man who is slouchy about his dress, and careless about his appearance and language, has grown up under unfavorable conditions, and among unpleasant surroundings. He has not seen things kept neat and beautiful at home, and those who have had charge of his home-life are to be blamed for whatever damage his reputation may sustain thereby. The extent of the injury thus inflicted is very great, and a parent has no moral right to send a child from his home with the stamp of such surroundings not only upon his appearance but also upon his mental and moral nature. If he cares nothing for beautiful things himself, the farmer has no right to destroy the sense of beauty which his child possesses as a direct gift from his MAKER. An elegant mansion and costly paintings are not needed, but neat yards, a house in good repair, a tasty garden, and plenty of trees and flowers are things, not merely of taste, but also of utility. They involve but little expense, but they have a powerful educating and refining effect. No one can do the best work of which he is capable in unpleasant surroundings, and the constant unhappiness which they involve make them destructive to both health and usefulness. It is therefore the duty of every man who has a home to make the surroundings of that home as pleasant as the means at his command will allow.

In order to make the surroundings pleasant, perfect neatness is one of the essential requisites. A plain yard which is neatly kept looks much better than one which has been elaborately laid out and then neglected. There should be a gravel walk, or a walk made of slats, from the road to each of the outside doors of the house. If there is a front fence it should be kept in repair, and often whitewashed or painted. Rose bushes and flowers should find a place in the yard, and be kept free from weeds. A few rustic ornaments will cost but little, and yet will add much to the appearance of the place. Three or four evergreen trees are also desirable in the yards. Climbing vines and flowering plants are cheap and pretty. Many other things, trifles in themselves but adding greatly to the general effect, can be obtained. A nice yard costs but little, except the work of keeping it clean, but it does much to make the home pleasant, and will add considerably to the cash value of the farm.

The effort to make things pleasant should not be wholly spent out-of-doors. The interior of the house should also be neat and pleasant. Boys, and girls too, dislike to spend all their spare hours in a dingy kitchen, and the wife and mother must find such a living-room unpleasant. There is no necessity for any one to be shut up in such a room during all the working hours of life. Yet many farmers' wives not only have to work, but also rest, when they are fortunate enough to obtain an opportunity to leave their work, in a kitchen which is colored with smoke, and furnished with only the plainest chairs. Every kitchen should be often whitewashed, and should contain an easy-chair in which the housewife can rest when she can spare a few moments from her work. In the afternoon and evening the sitting-room should be open and the children should be allowed to spend their time therein when not at work. Here plenty of books and papers, some expressly for the children, should be found, and musical instruments, if the tastes of the family lead in that direction, and their financial condition will warrant the expense. It is better to buy an ORGAN or PIANO for the children, and thus give them a taste for quiet home pleasures than it is to lay up money for them in the bank, and allow them to run in the streets, or to the neighbors for pleasure which they cannot find at home. The idea which many people have that the best room should only be opened for the use of company, is one of the theories which have worked an immense amount of mischief. A father and mother ought to care as much for their children as they do for any one in the world, but parents often refuse their children the use of the best rooms, which are freely opened for company even though that company may be distant, and not very highly prized, relatives. This is a wrong to the children. They are entitled to the first place in the affections and to the kindest treatment from their parents.

Let no one shrink from the duty of making the surroundings of his children as pleasant as possible. The cost is not very great, and not very much time will be required to keep the house and yards in order and make them present a neat and attractive appearance. Thus, the duty is made very light, and, as part of his reward, the parent is allowed to share the pleasure which is secured by its performance. But it is a duty which cannot be safely neglected. GOD has ordained that the home shall be the training-school of children, and that the children shall soon go out into the world as men and women bearing in unmistakable characters the impress of the home surroundings. They go into life on their own responsibility, and become accountable for their own actions, but there is a bias for good or evil which was given them at home, and which will go far toward determining their destiny.

LABOR, RECREATION, AND REST.

S a rule, to which there are comparatively few exceptions, farmers work too hard. They make too long days and take too few and too short vacations. It is very true that many of them do not find their labor rewarded as well as they hoped it would be, and are inclined to work still harder to secure the money for which they toil. Such a course is a great mistake. A higher degree of success is to be secured not by working more hours, but by a more skilful direction of the labor which is performed. More study is needed and better plans are required. A higher degree of skill is wanted. The horse-power and steam-power must be more freely used. The corn field which pro-

duces only thirty bushels of corn per acre must be made to yield sixty bushels without materially increasing the expense of cultivating the field. Grass and grain crops must be made to largely increase their present yield. This can be done by skillful management, but not by simply increasing the amount of labor performed.

That labor is a duty as well as a necessity, and a blessing as well as a positive requirement, there can be no possible doubt. The father who allows his children to grow up in idleness thereby inflicts upon them a great wrong, and the youth who wishes that he could live without work could have few wishes granted which would be more destructive to his happiness. Industry is not only the fountain of all wealth, but also the source of happiness and the preserver of health and virtue. The idle man is a useless member of society, is unhappy, and often miserable. He is exposed to many temptations which his industrious neighbor escapes, and is often led into ruinous evils of which he would have been wholly ignorant if his time had been filled with some useful labor. It is the duty, and is generally understood to be for the interest, of the farmer to work himself and teach his boys to work. But he should never make a slave of himself or of any of his children. The work of the boys should be proportioned to their strength, and they should not be discouraged by being crowded too hard. The farmer should lay out no more work than he has help to perform. The plan which is too often followed is to attempt to cultivate a great deal larger area of land than there is help to manage. Then all through the season there is a constant hurry and drive, every man and boy is crowded to his utmost, and, after all their exertions, the crops are not well cared for and are not remunerative. Better cultivate ten acres of corn well than to run over twenty acres.

The financial evils which result from an attempt to do too much are not the only ones which will come. The boys will become discontented and long for a life in the city or village where they imagine that the pay is large and the work is light. The effect upon their bodily health will also be pernicious. Many a boy never grows into a strong and healthy man because he was overworked while young. By spending too much time at work and performing labor beyond his strength to safely endure, he becomes weakened for life and falls an easy prey to disease. The middle-aged man sometimes so overworks as to weaken his vital powers and bring on premature old age. When a man works so hard that he can take no comfort in reading or social conversation, he is going beyond his strength and fast becoming a mere animal. There are men who have so slaved themselves, and injured their bodies and minds by toil, that they fall asleep as soon as they attempt to read or to converse on any subject which does not pertain to the labor in which they are engaged. Their joints are grown out of shape and they suffer greatly in body while broken down in mind. What benefit such a man can receive from the money which his labor brings we do not know. He may amass wealth, but he cannot enjoy it. He may escape being a pauper, but by going to the other extreme he becomes a slave. Every man should work regularly but not excessively. While labor is a duty, overwork is a sin. Idleness destroys a man one way, but excessive overwork will just as surely ruin him in another. No man has a right to live upon society while doing nothing for its welfare, and no one is justified in working so hard as to destroy his mental and physical powers.

While the farmer should require his children to work, he should not make this work the only education which they receive. On the contrary he should send them to the best schools which he can afford, and to college if possible. An education

is a great possession, and is as valuable for a farmer's boy as it is for the merchant's son. The girls should also receive the best education which their parents can supply. This should include a thorough acquaintance with all household duties. Not only should the farmer educate his children, but he should give them time for reading and study when out of school. The custom, once prevalent but now going, we hope, out of date, of requiring boys to work morning and evening while attending school, is to be severely condemned. Under this method the scholar was unable to do justice to himself at school, and the double strain proved a severe and unjustifiable draft upon his strength. Many a boy has ruined his health by trying to perform the double duties thus imposed.

The farmer should keep himself and his family supplied with reading of the best quality, and plenty of time in which to use it should be taken. Like the men in all other callings the farmer needs books and papers which are devoted to his special pursuit. The attempt to get along without them is ruinous. In these days of close competition the man who is to succeed *must* be well informed. Ignorance cannot successfully compete with knowledge. The boys, too, need these books and papers in order to give them an intelligent comprehension of the methods which should be pursued, and to lead them to take an active interest in the farm work. But they should not be restricted to this class of reading. The best papers for the young should be furnished, and the newspapers should also be supplied so that they and their sisters may know what is going on in the world. The wife and mother should not be forgotten, but some good home magazine should be taken for her especial benefit. She needs something of this kind still more than the other members of the family. She is tied more closely to the home, her duties are very exacting, and her health is often poor. The monotonous drudgery of isolated farm life has a terribly destructive effect if it is not counteracted by the rest and recreation which is always needed but seldom taken. When the ceaseless round has been too long followed the health of body or mind, or both, will give way. The ASYLUMS for the INSANE contain a very large proportion of farmers' wives brought there by the combined effects of overwork and a monotonous life. The magazine and newspaper lead the thoughts into new channels, occupy the mind with subjects outside of its ordinary routine, and thus refresh the body while preserving the health of the mind.

The farmer and his family all need periods of rest and recreation. An occasional day spent in visiting friends will be positively beneficial to the health, and will give an increased efficiency to the labor which is performed as well as properly develop the social feelings. The GRANGE has proved an immense aid to farmers and their families in these as well as in other directions. There was a great need of something which should lead them out of themselves, and break up the isolation and routine in which their lives were involved. Lectures and occasional concerts should also be attended, but all low shows, and even the ordinary grade of the circus, should be carefully avoided. A good managerie is an excellent thing for children and grown people to see, but many of the shows which travel around the country are of little value, and in some respects are extremely harmful. It is a good plan to give the last half of each Saturday afternoon to the boys and girls for their own enjoyment. Instead of trying, as too many do, to crowd about a third more work into Saturday than they perform any other day of the week, the farmers should make its labor lighter, and finish it early.

The evenings should never be devoted to work, but used for rest and mental enjoyment. We have known farmers who have done a large part of their husking

evenings, and who often performed other kinds of work after dark, but we never knew one who seemed to be a gainer thereby. The man who keeps his children at work from the time they get up until bed-time; inflicts upon them a great wrong, while the one who follows this course himself will, sooner or later, be obliged to bear the penalty of the violation of the laws of health. The man who is industrious during the day, and who works regularly, will accomplish a great deal during a year, and will perform all the labor which should be required of him. The evenings should be spent in a cheerful and well-lighted sitting-room, and the children should be encouraged to stay there instead of roaming the streets, or going to saloons or stores. If home is made pleasant and cheerful, most boys will think it the nicest place in the world, and will choose to spend their evenings in it rather than abroad. Books, papers, music, and harmless games (not including cards), together with kind treatment and cheerful conversation, will be powerful inducements for the average boy to keep out of bad company, and avoid all low and evil associates.

THE SABBATH furnishes a stated time for rest, and should be carefully observed. Some things must receive attention on this day, and the fact is often made an excuse for the performance of a great deal of work for which there is no justification. We have no sympathy with the strict literalism of the few who make the Sabbath a day of gloom, or with the extreme liberality of the many who make this a weekly holiday.

The Sabbath should be a happy day, but the pleasure secured should be of a different nature from that which is sought on other days. Works of strict necessity and mercy may be performed, but no labor should be done for the profit which may accrue or in order to save something which might otherwise run to waste. Attendance upon church and Sunday-school should be regular, and the Bible should be studied and its truths impressed upon the minds of the little ones. The best religious books and papers should be read, plenty of interesting religious and moral reading for the children ought to be supplied, and the day should be kept in a manner which will bring rest and refreshment to the body and peace to the mind and soul.

HEALTH AND DISEASE.

HEALTH is one of the greatest temporal blessings which man receives. It is seldom prized until it is lost, and, consequently, but little effort is put forth for its preservation. The birthright is often sold for a mess of pottage. But when it is lost the poor unfortunate finds that he has parted with a great possession. Good health is better than money. It is a large part of the capital of the laboring classes, and the source of much of the enjoyment of the rich. When it is lost the poor cannot work and the rich cannot be happy. When it is possessed it can usually be retained, even in spite of hereditary taints, but, when lost, its restoration is difficult and often impossible.

We shall not give a long list of prescriptions for the various diseases which afflict mankind. We think that every family should have a standard medical work and be familiar with its contents. The wife and mother should understand the best methods of nursing. In a multitude of cases of sickness more depends upon skilful care than upon the use of drugs, though there are many diseases in which medicines

must be used promptly and efficiently or the patient will not recover. *All* cases of sickness need good care. By this means, and the use of the common remedies with which the housewife should be familiar, mild attacks may be cured. Violent attacks, or the ordinary forms of certain severe and contagious diseases, call for prompt and skilful medical treatment. Never let a patient go on day after day without improvement before consulting a doctor. The system may get so enfeebled during the interval that it cannot rally when medical treatment is given. In a multitude of cases, doctors have been called too late. This is especially true of infants and aged people. These classes have but little vitality and but little power of endurance. Disease makes rapid progress, and, before danger is suspected, recovery becomes impossible. In many cases of disease if the doctor is called early he can check its progress, while, if he is not sent for until it has obtained a firm hold upon the system, it must run its course, and a long and expensive sickness is inevitable. Delay is dangerous, and much of the "home doctoring," and use of patent medicines, is almost equally hazardous. A standard medical work will give many useful hints, and a few of the best remedies for simple diseases should be kept constantly in the house, but the farmer should not attempt to doctor himself or his family in any serious form of sickness. He would not think of trying to repair his watch. He knows that he has not sufficient skill and knowledge to enable him to adjust such a fine and complicated piece of mechanism. Much more should he hesitate to ignorantly tamper with the wonderful human machine into which GOD himself has breathed the breath of life.

We believe that a large part of the sickness which afflicts mankind might be easily prevented by attention to the laws of health. Therefore, instead of giving a description of many "cure-alls," we shall simply call attention to a few of these laws and urge obedience thereto. GOD has made the human frame subject to these laws. Obedience will secure health and strength. Disease will be the penalty of transgression. To some of the great necessities of the human system we will briefly allude.

PURE AIR.—This is one of the great essentials to health, and one which, with a little care, can be secured in abundance. It has been generally supposed that the farmer and his family had plenty of air in almost absolute purity, but we doubt if the air in the average farm-house is as pure as that in the average city mansion. The air in the farm-house *ought* to be very pure, but there is such a lack of attention to ventilation, and so many decaying vegetables are allowed to remain in the cellar, while the drainage of the yards is so bad, and the stench from neglected closets and vaults is so strong, that the whole atmosphere in the vicinity is polluted, and the dweller in the country obliges himself and his family to breathe air that is wholly unfit for the purposes of respiration. The remedy is apparent. Remove all decaying substances, drain the land, use disinfectants freely, and ventilate thoroughly.

GOOD FOOD.—Without an abundance of good food no man can be well. The food supplies the waste of muscular tissue and of the brain. There is a constant process of waste and repair going on in the body. If the food is insufficient in quantity, or imperfect in quality, the waste is not fully supplied, the action of the organs is enfeebled, disease sets in, and in time death ensues. Farmers have food enough, but the quality is not always as good as it should be. To this fact much of the disease of farmers' wives and children may be traced. Nervous affections are often caused directly in this manner. This is proved by the fact that a speedy and radical cure can often be effected by a change in this one particular. DR. V. W.

BLANCHARD, of NEW YORK CITY, has originated a FOOD CURE system of restoring health. This system has now been in operation many years, and all kinds of disease have been treated with a very high degree of success. The only remedy employed is pure food, concentrated, and, for some diseases, subjected to a process of artificial digestion.

The art of cooking is not as well understood by farmers' wives as it should be, and in many cases they are overworked doing what is now required of them. If a change could be made which would insure the use of more beef and less pork, a largely increased consumption of vegetables and fruits, the substitution of simple dishes for some of those which require much time and labor in their preparation, and which would give a much greater variety of food with less work in fitting it for the table, there would be a great gain to each and every member of the household. The best food cooked in the best manner should find its way to the farmer's table. The *best* food can be obtained by the farmer as easily as by any one. The complicated and mysterious compounds which cause the tables, and also the stomachs, of the rich to groan do not come under this head. Good food is simple, nutritious, and simply prepared. It costs less than the dyspepsia-producing dishes which are often furnished, and not half the work is required to prepare it. Wheat, milk, beef, eggs, vegetables, and fruits, will gratify the taste, and furnish nutriment for the system. Oatmeal is a valuable article of food, especially for children. Properly cooked it can be made palatable, and with the addition of milk and sugar it becomes a popular dish. The farmer cannot afford the luxuries of the rich, but he can have food which will gratify the taste, and which will impart health and strength.

PURE WATER.—This is another of the great necessities of the system. A large proportion of the body is formed of water, and quite a quantity is required each day to supply the waste. If the water taken into the system is pure it refreshes and invigorates, but if it is not pure, and a great deal of the water in use on the farm is *not*, it becomes a source of danger, and soon brings on disease which often terminates fatally. Probably the use of impure water has led to more cases of typhoid fever than all other causes combined. Multitudes of cases of "fever and ague" are caused in this way, while many slow diseases which present a low type of fever, which undermine the constitution, and for which no definite cause can be assigned by the patient, are brought on in the same manner. The true cause of many attacks of disease is not suspected by the patients, their friends, or, until too late, by the physician. We have already dwelt upon this subject at some length, and need only say here that the greatest care should be exercised to keep the water which is used for cooking and drinking perfectly pure.

PROPER CLOTHING is required in order to maintain perfect health. Unfortunately its value is not duly appreciated, and multitudes of people on the farms in this country are not suitably clad. The majority have a sufficient quantity of clothing, but it either is not of the right kind, or else is not worn as it should be. The climate is very changeable and quite trying, not only to invalids but also to well people. In winter the farm house is very imperfectly warmed, and the members of the household are subjected to considerable exposure in passing from the warm to the cold rooms, and in sleeping in cold, close, and poorly ventilated apartments. Farmers' wives are often exposed to severe cold in hanging out clothes after working over the hot water used in washing, and all the members of the family frequently get the feet wet, and take cold as a natural consequence. Farmers are often severely exposed to attacks of disease by getting chilled after working hard and

getting unduly heated. Rheumatism and neuralgia, both fearful diseases, as we can certify from our own abundant experience, are often brought on in this way. The neglect to put on a coat when a hard day's work was done has cost many a man an immense amount of pain.

It is bad enough to sit down in a cool room when merely warm without putting on extra clothing, but when to the heated condition of the system exhaustion is added, the danger of a sudden chill, and the degree of danger from a chill, is greatly increased. *Never* sit in a draft of air to "cool off" after working, or at any other time. Always when tired and sweaty put on a coat as soon as the work in hand is finished. It is not safe to wait even for a few minutes. A coat should be carried to the field in warm weather, and worn to the house when the work is done. Waiting until he could get to the house has caused many a man to take a cold which resulted in serious sickness. *Always* wear woollen next to the skin. Thin woollen clothes in the summer, and thick ones in the winter should be worn. Not only the grown people but the children should also be dressed in this manner. The best medical authorities in this country and in EUROPE have strongly advised the use of woollen clothing at all seasons of the year.

As already suggested, more clothing is needed at night, when the system is exhausted by the labors of the day, than is required when at work. At all times sufficient clothing should be worn to keep the person comfortable, and in winter it should be of the best quality (as far as warmth is concerned), in order that it may afford sufficient protection without being burdensome. The same rule applies to the bed-clothes which are used. Newspapers folded between the quilts will give much warmth with little weight. *Never* sleep cold, but use clothes enough to keep warm. Keep the feet dry, if possible, during the day, and before retiring at night dry and warm them thoroughly. See that the children do not neglect this. Attacks of croup, and severe lung diseases, are often induced by going to bed with cold, damp feet.

Avoid exposure to storms. If caught out in one, change the clothing as soon as possible, and rub the skin vigorously until it is all aglow. Keep the children indoors during rain and snow storms. No possible good can come of their being out and it may lead to severe illness.

CLEANLINESS.—Much of the work on a farm seems directly opposed to cleanliness, yet there is no impossibility, even for the farmer, to obey this plain and important law of health. The two millions of little pores in the skin are the outlets by which an immense amount of waste matter is removed from the body. If these outlets become closed, by reason of a cold, or of an accumulation of dirt upon the surface, this matter is thrown upon the internal organs, thus greatly increasing their labor, and also poisoning the whole system. Frequent bathing is absolutely necessary to secure cleanliness, and, sooner or later, every one will find that cleanliness is indispensable to health. The feet need frequent washings. Many people are troubled with cold feet who would not be if they washed them more frequently. Putting the feet into hot water and keeping them in it ten minutes, adding more warm water as that in the pail grows cool, will often quiet a severe headache so that the patient can sleep. Sleeplessness, unattended by pain, can sometimes be cured by dipping the feet in cold water and rubbing smartly with a coarse towel just before going to bed. When there is a disagreeable odor, wash the feet with water in which permanganate of potash—ten grains to a pint of water—has been dissolved. Or they may be occasionally washed with vinegar.

Wash the head, frequently and thoroughly, with water and the best toilet soap. *Never* use "bears' grease," or any other grease, and avoid all dyes for the hair and beard.

The teeth should be brushed after every meal, and particles of food lodged between them should be removed with a sharpened quill. Prepared chalk is a good tooth powder. So is a nice grade of soap. A little salt will make the teeth very white. This should not be used often, and the mouth should be thoroughly rinsed with water after it has been applied. If the stomach is disordered, the teeth will often be injured by an acid reaction. To prevent this, rinse the mouth quite often with a solution of common baking soda, using a teaspoonful to a glass of water. Also take proper remedies to correct the action of the stomach.

Have the teeth examined once in three months by a competent dentist, and when there are indications of decay have the cavities promptly filled. The loss of the teeth will cause a great deal of pain, and be very likely to lead to indigestion and serious illness. Children should be taught to take care of their teeth, and a dentist should be employed to fill any cavities which may appear. If attended to soon enough, all the teeth can be preserved until old age. But the majority of young people do not commence the work of preservation early enough. They wait until the teeth are too badly decayed to be filled and then have to lose them. It pays to have a dentist examine the teeth often. He can detect the beginnings of evil, and save teeth which would be lost if the owner relied upon his own powers of observation.

We have elsewhere alluded to the great importance of keeping the cellars and all the surroundings clean, and need not dwell upon it here. DR. BOWDITCH has said, and the experience of the past has proved him correct, that "all filth is absolute poison" to the human system. Either in the air we breathe, the food we eat, the water we drink, or through the pores of the skin, this poison may enter the body and carry on its ruinous work.

SUFFICIENT SLEEP is one of the most important requisites to secure health and vigor of body and mind. During sleep the repairing of the waste of the body and the brain is going on and rest is secured. If the period allotted to sleep is too short, the work is imperfectly performed, and weariness during the day is the result. The candle of life is being burned at both ends. If the habit of taking too little sleep becomes fixed, sickness, perhaps insanity, will result. Many a man has died in youth or middle age who would have lived many years longer if he had taken more time for sleep, and many a farmer's wife has gone to the INSANE ASYLUM, or an early grave, because the ceaseless round of duties which she tried to perform left too little time for sleep. Multitudes of children are being injured in body and mind by a lack of sufficient sleep. Their parents teach them that it is a sign of laziness to lie long in bed. No greater delusion was ever accepted by mankind. Shorten the hours of sleep and you thereby sap the very fountains of vital power. Unless preceded by early retiring, early rising is a slow, but sure, form of suicide. Better do without food than without sleep, if both cannot be secured. The greatest workers in the world are often great sleepers. We know of a brilliant clergyman, who performs an immense amount of labor, who sleeps twelve hours out of the twenty-four. The most vigorous men take an abundance of sleep. Some people need more sleep than others. Probably the majority require eight hours. Many need ten hours, and some even twelve hours, sleep out of each twenty-four. Each individual must be a law to himself. If he needs but eight hours sleep he should take only that amount,

but if he needs more let him take it. No matter if neighbors borrow trouble about it. It is not their business. But it *is* the business of every person to get sleep enough. If a small supply of sleep is taken there will be a dull, heavy feeling all day long, and not as much work can be done as can be performed in a much shorter day if the hours devoted to sleep are increased. The man who sleeps well can do more work in eight hours than one who sleeps too little can do in a longer time, and can do it with far greater ease. Many nervous diseases are brought on by shortening the hours of sleep, and other evil results will surely follow in due time. Parents should see that their children have plenty of time for sleep, and should allow their servants the privilege of securing abundant rest.

OBEDIENCE TO MORAL LAWS.—This is the last of the essentials to the preservation of health to which we shall call attention. The AUTHOR of these laws is also the AUTHOR of the laws of health. "HE knoweth our frame," and HIS laws have been made with reference to our necessities and our powers. A pure and moral life tends to promote the health of the body and the mind. A vicious life tends to the direct ruin of both. Indulgence of the appetites and passions deranges the nervous system and lowers the vital power. Many diseases are induced thereby, and the body is so weakened by indulgence that it falls an easy prey to attacks of sickness which otherwise might have been easily resisted. The use of tobacco, or of intoxicants, lets down the tone of the system and often leads to ruined health. Any and every bad habit, whether it be of a physical or a moral nature, tends to impair the health and break down the constitution, while a thoroughly CHRISTIAN course of conduct not only makes a man happy, respected, and useful, but also has a powerful influence to ward off disease and strengthen the mental and physical powers.

BOYS ON THE FARM.

HOW to keep the boys on the farm and induce them cheerfully to choose farming as their occupation for life is a question of deep interest to many parents. The stampede of young men from the country to cities and large towns is not an evil which finds its limit in the domestic circles which they leave, but is one which extends through society and makes its depressing influence felt everywhere. How to check this evil is a question of great importance and is well worthy of consideration.

In order to induce the boys to stay on the farm they must be informed of the true relation which exists between the city and the country. They must be shown that the expenses of living are so high that the city clerk, whom they envy because of his large salary, can hardly keep out of debt. And the fact that the man in the city is tied to his business a great deal more closely than the farmer is to his work should be set before them. Many of the boys who have left the farm have done so because they were allowed so few pleasures and so little time at home. Their fathers were not wise in their choice of methods of government and labor. Still, there will be many boys who, under any system of treatment, will choose other professions rather than work on the farm. It is best that this should be so. Boys who have a strong inclination to follow any honest calling will usually do better in that department of labor than they can in any other. But this inclination can often be guided, or even formed, by wise counsel and suitable influences. The father who greatly desires to

see his boys become farmers can, by means of wise and careful training, usually carry his wish into effect.

Boys should be taught that farming is an *honorable occupation*. It is very true that the calling does not make the man, and that a man should not be respected because he follows one honest occupation or despised because he follows another. Character is what a man *is*, and cannot always be determined by reference to the kind of work which he performs. The farmer may be a gentleman or he can be a boor, he may build up a noble character or he may be a villain. He makes his own choice in these respects. Merely being a farmer will make him neither a good man nor a bad one. Still, farming is a business which does not open to its followers so many evil influences, and 'expose them to as many temptations, as some lines of business. It is the kind of labor which GOD directly marked out for man, and upon the cultivation of the soil the civilization and happiness of mankind must, in a great measure, depend. As far as occupation is concerned, the farmer has no occasion to "look up to" the merchant, manufacturer, or professional man. Clergymen and teachers are doing a work the value of which is beyond all price, and many boys will be called from the farm to fill the ranks of these professions. The ones whom GOD calls into these fields should not hesitate for a moment to obey. But before a boy leaves the farm to become a merchant, or to go to a city as a laborer, or to engage in business of any kind, he should very carefully consider the question whether there is any good prospect that he can do better than the thousands of those who have preceded him, and who have soon been led to repent that they ever left the farm.

The boys who are designed by their parents for farmers should be led to take an interest in their work. The skilful teacher leads his scholars along both rapidly and pleasantly when he gets them fully interested in their studies, but until he can do this their progress will be very slow. The boy who "don't care" about farming may be led to take an interest in it and choose it for his life-work. If the farmer would explain to him the way in which plants grow, and tell him why certain operations are performed at the particular times which he observes, and also furnish him with books and papers treating of these and of kindred subjects, he would soon find that the indifference had given way to earnest inquiry and deep interest.

Life on the farm must be made pleasant to the boys who are designed to follow the calling of their fathers. The young have a firm belief that life ought to yield a great deal of pleasure, and if things are unpleasant at home they will go elsewhere in hope of bettering their condition. This hope is often disappointed, yet the boys press on as though it were sure to be realized. The parent ought to strive to make his children so happy at home that they will prefer it to all other places. We do not mean that the child should always have his own way. Far from it. Parental authority ought to be firmly maintained. But the rule should be very gentle and the natural waywardness of youth should not cause the father to lose all patience with his boys. The average boy who is well treated is not as exacting as many people seem to imagine. He can be made contented with reasonable care and attention. We have already alluded to the necessity of furnishing him books and papers, and a pleasant room in which to spend his evenings. He should also be well clothed and furnished with what spending money he really needs. Coarse clothes can, and should, be worn while at work, but every farmer's boy should have good clothes in which he can go into company without being ridiculed or feeling that he is unsuitably dressed. He should be taught to respect himself and his occupation.

He ought never to be obliged to overwork, and his home-life and surroundings should be made as pleasant as possible.

The girls must be taught to respect farming as an occupation, and be required to help their mothers in the work of the house and the dairy. When farmers educate their girls in a manner which will fit them to become farmers' wives, and teach them that farming is one of the most honorable of all occupations, and that the girl who marries a farmer does fully as well as one who marries a merchant or a lawyer, they will thereby do a great deal towards keeping their boys on the farm. The idea that because a young lady has married a farmer she has "thrown herself away" is one of the most preposterous ones which ever found expression in civilized society. The girl who will reject a man simply because he is a farmer shows that she has a very shallow or else a sadly uncultivated mind and a heart which is incapable of deep affection. And the farmer who will advise his daughters to reject honest and intelligent farmers in the hope of securing clerks, business or professional men, thereby shows his own lack of good judgment as well as proves that he has no genuine respect for the calling by means of which he obtains his bread. The mother who advises her daughters to "look higher" than the young men who are farmers is thereby doing a great wrong. There may be reasons why certain farmers' boys are not suitable companions for certain farmers' girls, but the mere fact that the men are farmers should weigh in their favor rather than against them.

We are well aware that many farmers' wives have been terribly overworked, and we can sympathize with the mother who desires an easier lot for her child. But we know that this excessive labor is not an absolute necessity, and that with the aid of the labor-saving implements of the present day a farmer's wife can live as easily as the wives of men engaged in many other pursuits. There is a very general misconception upon this point, but those who seek the truth soon find that the wife of the farmer does not need to overwork, and that she can have many comforts which other men's wives must purchase at high prices or else do without. The wife of the farmer ought to be willing to work in order to help him, and if the man is what he should be he will see to it that she does not go beyond her strength. And any and every girl may rest fully assured of the fact that a man who would make her his slave if he were a farmer would also require her to work extremely hard if he engaged in another occupation.

One of the ways in which the boys can be strongly influenced to choose farming as an occupation is by giving them the use of a small piece of land each season. Let each boy who is old enough take a plot of land each spring, and plant it with such seeds as he chooses. Give him time to cultivate the crop, and allow him to use the team when he needs it. The money obtained from the sale of the products of this piece of ground should be his own to use as he desires. Such a course will prove beneficial in several ways. It will lead the boy to take a deep interest in thorough farming, and induce him to study the best methods of cultivation in order that he may obtain as large a sum of money as possible. It will show him the real worth of a dollar, and lead him to spend his money wisely.

Many a boy has soon "run out" a fine property left him by his father, because he had no clear comprehension of the difficulty of obtaining money. The father who gives his boy spending money does a great deal better than the one who never allows him to have any, but it is by far the best plan to have the boy earn the money which he spends. The boy who earns a dollar by growing fruit or grain, understands that the dollar represents a certain amount of labor. He appreciates

the money, and knows its actual worth far better than the boy whose father gives him some outright. Such a plan will enable the boy to buy books, or take papers, with his own money. It will tend to make him industrious and frugal, and may be made the means of great good to the boy, and, indirectly, prove an almost equal benefit to the father. If it is not convenient to allow the use of land, the farmer may give his boys the entire care of the poultry, requiring them to pay for the food which is consumed, and allowing them to retain the money received from the sale of chickens and eggs. Or two or three sheep may be given to a boy to care for, he paying the cost of keeping, and having the money obtained from lambs and wool for his own. In some such way the boy may be inspired with a love for the farm, and induced to lay a good foundation for a successful business career thereon.

The farmer who desires his boys to become farmers should take them into his confidence, and consult with them in regard to the work. Upon this point PROF. BEAL, of the MICHIGAN AGRICULTURAL COLLEGE, has well said: "If you want to make your son like his business, place him in responsible places, trust him, consult him about the work he is to do. Let him do part of the thinking. Give him nearly the sole care or responsibility of something on the farm, the fowls, the pigs, some of the stock, some of the crops, or the garden, or a part of it. Suppose he does not do everything just as you would; advise him. It is much better that he should fail while he is yet young and has time to learn under your training, than not to try or fail until he gets into business for himself. By treating children in this way they will take more interest in their work, and be much more likely to succeed when they start for themselves." It would be much better, both for children and their parents, if the boys were consulted oftener, and trusted more than they usually are on the farm. As some writer has said: "The sooner a boy can be made to wait on himself, to think for himself, and to act for himself, the sooner will the germs of true manhood begin to develop within him." The farmer's boys should be made to bear some business responsibility, and the girls should, in their own department, be trained in like manner.

If the suggestions made in this chapter are heeded, the great majority of the boys will have no difficulty in making up their minds to stay on the farm. If their parents understand them, and treat them well during their minority, and give them, if possible, a moderate degree of help when they become of age, the boys of the present and of future generations will not flock to the cities and towns, but will become intelligent and successful farmers.

ITEMS FOR THE HOUSE AND FARM.

THE following items, collected from various sources, may often prove useful to the housekeeper and the farmer.

NEWSPAPERS and wrapping papers can be put into many valuable uses in the household. Few housekeepers can find time to black their cooking stoves, every day, and even if they wash them every day in clean water they will soon become quite shabby; but if they are rubbed over with a newspaper every morning, after the dishes are washed, they will keep black a long time. If a spot of grease or stain of some kind adhere, moisten the paper a little and rub it off. Newspapers or wrapping paper will keep the outside of the tea and coffee pot, and all tin utensils about the stove, brighter than the old way of washing them in soap-suds.

FLOUR and meal of all kinds should be kept in a dry, cool place. Oranges and lemons keep best when wrapped close in soft paper, and laid in a drawer. Keep coffee by itself in tin canisters, if possible; its odor affects other articles. Keep tea in a close canister, to preserve its aroma.

CLEAR, boiling water will remove tea stains. Pour the water through the stain, and thus prevent it spreading over the fabric.

LINEN may be glazed by adding a teaspoonful of salt, and one of finely scraped soap to a pint of starch.

KEROSENE will make tin tea-kettles as bright as new. Saturate a woollen rag and rub with it. It will also remove stains from clean, varnished furniture.

A **SIMPLE** and excellent furniture-polish may be made as follows: Take one pennyworth of beeswax, and shave it with a knife into a gallipot. Pour on it three pennyworth of turpentine. Place it in the oven, and when the beeswax is melted take it out, and let it stand till cool. Apply it briskly to the furniture with a piece of flannel, rub with a soft duster, and finally polish with an old silk handkerchief. Oil-cloth may with advantage be similarly cleaned.

TO REMOVE PAINT FROM WINDOWS.—A simple method is to dissolve soda in very hot water, and apply to the windows with a piece of soft flannel. It will entirely remove the paint.

TO REMOVE old putty, rub it with a hot iron. This will soften it so that it can be easily taken off with a knife.

BEFORE WHITEWASHING the walls of a room wash them with a solution of copperas. This will disinfect mouldy places, and destroy the eggs of vermin.

DISINFECTANT FLUID.—Ten pounds sulphate of iron (copperas) dissolved in six gallons of water. Add one half pint crude carbolic acid.

WHITEWASH FOR OUTSIDE EXPOSURE.—Lime, $\frac{1}{2}$ bushel slacked in a barrel. Add 1 pound common salt, $\frac{1}{2}$ pound sulphate of zinc, 1 gallon sweet milk.

TO MAKE PAPER STICK TO WHITEWASHED WALLS.—Make a sizing, of common glue and water, of the consistency of linseed oil, and apply it with the whitewash or other brush to the wall, taking care to go over every part, and especially the top and bottom. Apply the paper in the ordinary way.

Always remove the old paper from walls before applying new.

TO MEND RUBBER-SHOES.—Get a piece of rubber—an old shoe—vulcanized rubber will not do; cut it into small bits. Put it into a bottle, and cover to twice its depth with spirits of turpentine or refined coal-tar naphtha—not petroleum naphtha. Stop the bottle and set to one side, shaking it frequently. The rubber will soon dissolve. Then take the shoe and press the rip or cut close together, and put on the rubber solution with a camel's-hair brush. Continue to apply as fast as it dries, until a thorough coating is formed. Spirits of turpentine dissolves the rubber slowest, but forms the most elastic cement.

LEATHER CEMENT.—Dissolve gutta-percha in a sufficient quantity of chloroform to make it of honey-like consistency—it will take a few days—cork tight—shake occasionally. Patches can be put on with it, so they defy detection. Directions for use: Have both parts clean and rough. Apply the cement twice to both parts and dry ten minutes. After it becomes dry, warm both parts gently, until the cement is thoroughly melted. Apply immediately—hammer lightly—ready for use in ten minutes. Shake well before using.

Kerosene will soften boots and shoes that have been hardened by water, and will render them pliable as new.

WET BOOTS.—Fill wet boots with dry oats and let them stand over night; the oats will absorb the moisture and leave the boots soft and dry.

TO PREVENT METALS FROM RUSTING.—Apply a thin coating of a mixture made of three parts of lard and one of rosin. This will prevent Russia-iron stoves, grates, brass, copper, and steel from rusting in summer, even in damp weather.

TO CLEAN THE HANDS thoroughly, prevent cracking, and make them white and soft, rub them well with soft-soap and sand, and then wash in warm water.

OIL may be removed from the hands by rubbing them well with dry mustard, and then washing them with cold water.

REMEDY FOR FELONS.—The London *Lancet* recommends the following as the best remedy yet discovered: As soon as the disease is felt, put directly over the spot a fly-blister about the size of your thumb nail, and let it remain for six hours, at the expiration of which time, directly under the surface of the blister, may be seen the felon, which can instantly be taken out with the point of a needle or a lancet.

REMEDIES FOR BEE-STINGS.—Extract the sting, if possible, and press upon the spot with a hollow instrument (a watch-key will do), in order to remove the poison. Then wet the affected part and cover with common baking soda.

If this is not convenient, cover with mud.

An onion cut open and one-half laid upon the spot is said to be a good remedy.

Whatever is used, *promptness* is indispensable to its successful application.

MUSTARD PLASTER.—In making a mustard plaster, use no water whatever, but mix the mustard with the white of an egg, and the result will be a plaster that will draw perfectly, but will not produce a blister, even upon the skin of an infant, no matter how long it is allowed to remain on the part.

ANTIDOTES FOR POISONING.

Arsenic.—If any one be poisoned with arsenic, administer mustard-water until vomiting is produced. The mixture is made by stirring two tablespoonfuls of ground mustard in a quart of lukewarm water. After vomiting has taken place, give a teaspoonful of sulphur or a wine-glass of soap and water. If with sugar of lead or white lead, use the mustard-water made as above, to produce vomiting, and after, a teaspoonful of Epsom salts dissolved in water, every forty-five minutes.

Corrosive Sublimate.—Give to a person poisoned by corrosive sublimate, white and red precipitate or calomel, white of eggs, milk, or oil in as great quantities as the person can take, during ten minutes, then give mustard-water as stated above.

Nitrate of Silver.—Give to a person poisoned by nitrate of silver or lunar caustic, table salt, two teaspoonfuls in a pint of water, then castor oil.

Strychnine.—Give to a person poisoned by either strychnine, nux vomica, opium, laudanum, paregoric, morphine, belladonna, or croton oil, an emetic of mustard and warm water, followed by a drink made of vinegar and sweet oil. In all cases of poisoning send for a physician *as soon as possible*.

A TABLESPOONFUL of turpentine, boiled with white clothes, will greatly aid the whitening process.

BEEWAX and salt will make rusty flat-irons as clean and smooth as glass. Tie a lump of wax in a rag and keep it for that purpose. When the irons are hot, rub them first with the wax rag, then scour with a paper or cloth sprinkled with salt.

A TRANSPARENT MUCILAGE of great tenacity may be made by mixing rice flour with cold water and letting it gently simmer over the fire.

TO CLEAN KID GLOVES.—Take benzine and dip the gloves into it, wring them

out, one at a time, and spread upon a board which has been covered with flannel, rub every part gently with a clean piece of flannel till dry; smooth out and hang in the open air till the odor has vanished.

TO KEEP the hands from chapping, dry them thoroughly immediately after washing them and before going into the cold.

CLEANING THE TEETH.—Before cleaning the teeth dip the brush in water, rub it over genuine white Castile soap, then dip it in prepared chalk.

TO KEEP ants away from food, set it on a table, and place each leg of the table in a dish containing water.

TO RID a house of insects: If two or three bottles of ammonia are left unstoppered, in prominent places in a room, they will soon leave. No insects can tolerate it.

EVERY pantry should be furnished with a good step-ladder, so that the house-keeper can easily get to the upper shelves.

TO REMOVE a glass stopper that has become firmly fastened in the neck of the bottle, put a drop or two of glycerine or sweet oil in the crevice about the stopper, and in an hour or two it will be loose.

TO CLEANSE a drain pipe, pour down a strong solution of copperas. The same material may be used for disinfecting cellars.

TO GET rid of mould in the cellar, put some roll-brimstone into a pan, and set fire to it; close the doors, making the cellar as nearly air-tight as possible for two or three hours, when the fungi will be destroyed, and the mould will be dried up. Repeat this simple and inexpensive operation every two or three months, and you will have your cellar free from all parasitical growth.

RATS AND MICE can be driven away by placing caustic potash or unslacked lime, powdered, in their holes or runways.

WARNINGS TO BE LEARNED BY HEART ABOUT KEROSENE.—Always fill lamps by daylight, and *never* while lighted. If obliged to fill them at night, have the light a few feet distant.

Lamps should be filled daily, and never lighted when partly empty.

Select lamps which have the burner considerably elevated above the body of the lamp.

Trim the wick square across to get the best light.

A lamp with the wick turned far down is more likely to explode.

If burning oil gets upon the floor, smother it with a rug or blanket.

If your clothes take fire, do the same, and *lie down*.

Never pour oil on a fire from a can—*never*. The observance of these rules *may* save many a life.

ENAMEL FOR SHIRT BOSOMS.—Melt together with a gentle heat, one ounce of white wax, and two ounces of spermaceti; prepare in the usual way a sufficient quantity of starch for a dozen bosoms, put into it a piece of this enamel the size of a hazel nut, and in proportion for a larger number. This will give clothes a beautiful polish.

A STRONG CEMENT.—A colorless, transparent cement, with which to mend glass, can easily be made by dissolving isinglass in spirits of wine; add a small quantity of water, and mix gently over a moderate fire.

AN ADHESIVE PASTE.—The *American Cultivator* gives this recipe for such paste as is used on the backs of postage stamps: Dextrine, two ounces; acetic acid, four drachms; water, two and a half ounces. Mix the dextrine, acetic acid, and water, stirring until thoroughly mixed; and add alcohol. For attaching labels to

tin, rub the surface with a mixture of muriatic acid and alcohol; apply the label with a very thin coating of the paste, and it will adhere almost as well as on glass.

PAINTING, or charring, *green* timber will hasten its decay.

A GALVANIZED wire clothes-line will outlast a dozen cotton or hemp lines, and, as it can be left out-of-doors without injury, will save a great deal of time and trouble now expended in putting out and taking in the common ones. The wire lines are much cheaper in the end than the others, and it will pay the farmer to set some strong posts and buy a suitable line. As the clothes will not freeze to the wire, and there is no danger of its breaking and letting the clothes upon the ground, his wife will be greatly pleased with the change.

A LARGE block cut so as to form two steps, and located at the front gate, will prove a great convenience to the ladies in getting into or out of a wagon.

WATERING TREES.—A correspondent of the NEW YORK TRIBUNE recommends the following method. When trees dry up in summer, never water the top of the ground and thus hasten death, but make a hole with a crowbar, near the trunk, and reaching to the bottom of the tree, pour in water until the whole space under the surface is thoroughly soaked. Then fill the hole with dry earth, and cover the top of the ground with manure or boards to keep it from drying. One such watering will last for a long time.

AMMONIA FOR HOUSEWIVES' USE.—In a farm-house the pantry-shelves will get grimy, and there are very apt to be finger-marks around the door-latches and knobs. It is hard work to scour all the time, and it wears off the paint too. Now if the housewife has a bottle of spirits of ammonia to use, she can take a basin of water and a clean cloth, put on a few drops of the fluid, and easily wipe off all the dirt. This is worth more than half a day's labor, and does not injure the paint. By putting a few drops in the dish-water, the dishes can be easily cleaned. By rubbing the windows with a sponge moistened with ammonia, they can be made to shine like crystal. Ammonia will take the stains off the teaspoons, and a teaspoonful in the mop-pail will do more in washing the kitchen-floor than a large amount of hard labor performed in the ordinary manner.

RED-LETTER DAYS.

IN the old calendars the saints' days were marked with red letters. These days were considered peculiarly fortunate and auspicious, and were often kept as holidays by the people. Had they not been marred by an undue veneration of men the principle and practice would both have been worthy of commendation. The custom is worthy of re-establishment upon a better basis.

In the bustle and haste of modern life there are too few holidays, and these are too often allowed to pass by unobserved. If other generations have paid too much attention to times and seasons, and unduly magnified the days which they have observed, the present generation has certainly gone to the other extreme. We need more holidays—not for popular observance, but for the family circle. We need them to prevent the excessive wear of constant toil, and also to strengthen domestic ties. Each family should have its own days, and a few of the public festivals should be observed.

BIRTHDAYS are entitled to a prominent place in the list of the red-letter days.

For the children these days should be made happy by gifts and by a pleasant party, or by a pleasure-ride to some place which they specially desire to visit. Older people should take these days for thought, rest, and recreation. It is fitting that these points of time should be observed, and that, as the years pass by, and age gradually but surely increases, the individual should recognize the fact that life is passing, and the time which he is to spend upon the earth is rapidly diminishing. They need not be sad days, but they should be remembered and suitably observed.

Parents should teach their children to remember these days. The custom which some writers advocated long ago, of planting a tree to commemorate the birth of each child, is to be strongly commended. As soon after a child is born as the proper season for transplanting arrives let a fine tree, oak, elm, maple, evergreen, or one of similar nature, be planted in one of the yards near the house. This tree should be the special care of the child in whose honor it was put out, and as they grow in size and age the child will take a deep interest in the tree, and will soon come to regard it with feelings of affection.

MARRIAGE ANNIVERSARIES should also be observed by the married members of the family. They may well be celebrated by social unions of the family circles to which the married pair originally belonged. When this is impracticable, a visit to some near relatives, a tea-party, or a pleasure-trip, will furnish the means for the appropriate observance of the day.

THE RELIGIOUS AND NATIONAL FESTIVALS which have received the sanction of the CHURCH and STATE should also be observed. The patriot should teach his children the reasons why the FOURTH OF JULY is kept as a holiday by the citizens of the country, and should lead them to observe it aright. The use of powder is not the only way, and is very far from being the best way, in which to have a "celebration." The story of the REVOLUTION should be familiar to every child, and a true patriotism should be made one of the prominent points of a good character.

THANKSGIVING DAY should be observed by every family in the land. When possible the parents and children should all "go up to the house of the LORD" to express in a public manner their recognition of the numberless blessings which they have received. The GIVER of all good ought to be offered the tribute of grateful hearts.

CHRISTMAS should be kept as a religious and a joyful festival. Gifts should be presented to the children, and they should be told the wonderful story of the coming of CHRIST into the world. The fact should also be clearly presented that all our civilization and liberty come to us as the direct result of the life and work of CHRIST on earth, while all our hopes for the future must depend upon HIM as the only REDEEMER of the world.

NEW YEAR'S DAY is fast becoming a festival, and if properly observed may be made instrumental of good. During the week preceding this day the poor should be remembered, and many kindly, but unobtrusive, acts of charity performed.

There are other festivals, like EASTER, which are worthy of general remembrance, and each family will have special days which should be kept by its members as anniversaries. Let these red-letter days not be overlooked or disregarded. Properly kept they will confer great blessings upon all who come under their influence and share their joys.

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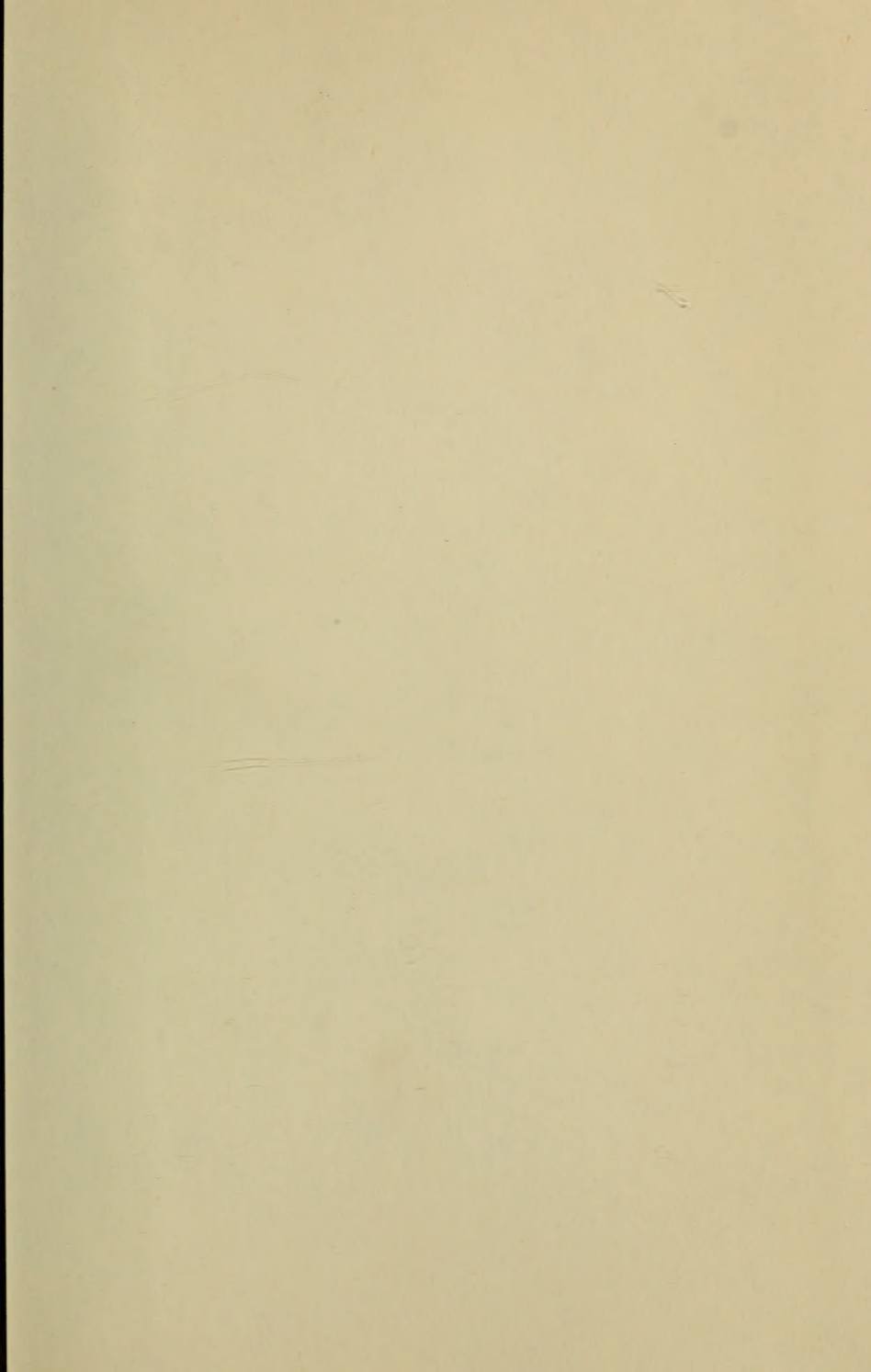
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